THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE COST OF THE ELECTRIC VEHICLE.

AT the recent Annual Convention of the Electric Vehicle Association of America, judging from the abridged reports of the meetings, one point which cropped up rather persistently was the first cost of the electric vehicle. We have not previously noticed that our American friends have had much to say on the subject of high first cost, but this feature of the "electric" has by no means passed unnoticed here, where the limited demand up to the present for such vehicles may, to some extent, be said to have justified the prices charged.

President Smith—who is a central-station man—pointed out that a number of manufacturers had given serious thought to the development of a moderately priced delivery wagon, and one important manufacturer had exhibited at New York, in October, a 750-lb. delivery wagon to cost £175. He considered that there was unquestionably a great opportunity for a large volume of commercial vehicle business in the field occupied by the small buyer, and that this had not been developed to any extent, and should have the attention of all concerned. He held that the passenger "electric" was not necessarily in competition with the lower-priced motor vehicles of other types, and output was the controlling factor with which the manufacturer had to contend. This was due to the nature of the present popular type of electric vehicle—the enclosed coupé or brougham, with its battery, motor, controller, expensive body, &c.

The solution to the problem of introducing and successfully marketing a low-priced electric car was increased output, and if doubling or trebling the present output would produce costs which would permit of competition with lower-priced vehicles, there should be manufacturers both with capital and courage to seek these lower costs. There would always continue to be a market for the exclusive and luxurious car, and this field was well covered.

These remarks show that even in the States, where the electric vehicle business is in an advanced stage of development, and manufacturers are eager to take up immediately any proposition which will ultimately advance their interests, there has so far been no marked movement by vehicle makers to cater for low-priced vehicle users.

It is true that the demand for such a car has been recognised; there have, for instance, been various reports as to the appearance of a cheap Ford electric car, in the design of which Edison was to be associated, and it is now stated that a low-priced "Edison-Ford" vehicle, consisting of a modified Ford petrol chassis fitted with a new type of light Edison battery, will be on sale next year. But the remarks made in the discussions on the various papers clearly indicate that our American friends, who are in the best position to judge, hold very undecided opinions as to the feasibility of turning out a low-priced electric car which will be a practical success.

One speaker pointed out that the average price paid for an electric vehicle was £520; another stated that the individual cost of 70 per cent. of the passenger gasoline cars was under £400, while the cost of 85 per cent. of the electric cars was in excess of that amount, and added the opinion that a car capable of running 50 miles on a charge and selling at about £140 was needed by the industry. Others denied that there was any demand for a car at this figure, on the ground that its low cost necessarily implied limited battery capacity and mileage, while it was further urged that talking of the low-priced "electric" created an impression that such a car would soon be available, and was harmful to the industry.

Mr. Geo. H. Kelly, who read a paper on "The Cost of Electric Vehicles," pointed out that the total electric vehicle sales were comparatively small, and that they fluctuated to such an extent that it was impossible to anticipate production, and for this reason it was difficult to produce a low-priced car, although, he added, passenger cars made to sell at £240 to £400 had never been a success. He considered that, contrary to the popular impression, the actual cost of selling electric cars was about half of that for selling petrol cars, so that the reasons for the high price of the electric passenger car were the high grade of material used and the expert workmanship necessary.

Mr. H. H. Doering, in a paper on electric vehicle manufacture, also had something to say on this subject. In his opinion, the time of cheap electric vehicles had come and gone, and manufacturers were meeting the demand of the public, which was for a heavy, luxurious, high-speed car. Quality set the price, and the "electric" was built to last, unlike the—presumably, American—petrol car. Mr. Doering pointed out that the largest manufacturer of electric passenger cars had an output of less than 1,500 cars a year, and the six next largest manufacturers had an output each of less than 1,000 cars a year, and this limited output rendered it impossible to lower the price. He added that the cheap "electric" failed because the battery capacity was insufficient, the speed too low, and the appearance objectionable, thus repeating opinions expressed by another speaker at an early stage of the meeting in an address entitled, "An Answer to Dr. Steinmetz," who, it may be remembered, recently advanced the view that the requirements of the future electric car were moderate speed and radius, and a price not exceeding £100 (see Elec. Rev., October 16th last, page 542).

Nevertheless, there were speakers who favoured the view that a moderately priced vehicle was wanted, and was within the scope of manufacturing to-day. On the whole, we should imagine that the arguments against the idea of a cheaper vehicle proved unconvincing to all except, possibly, vehicle manufacturers.

The suggestion, for instance, that the high price of the "electric" was due to the high grade of material used and expert workmanship necessary, cannot be reconciled with the fact that the far more complex petrol car, with its admittedly excellent workmanship and reliability, can be purchased for less money.

Even the argument as to limited output is lacking in effect, chassis building, battery construction, and motor and controller manufacture being all well developed businesses at the present time carried on by long established firms, whose experience and expert methods of production are available for the electric vehicle maker, and should by comparison with the earlier difficulties of automobile builders make his task really simple.

Indeed, amongst the talking points of the "electric" are its extreme simplicity and the fact that constructively it merely consists of parts which have been tried and tested on a large scale in other directions for years, and the average purchaser may be pardoned for failing to reconcile these features with high price.

In this connection our American friends may remember the saying of one of themselves that: "You can fool some of the people all of the time, and all of the people some of the time, but not all of the people all of the time."

Business men the world over are mostly of the hard-headed variety, and to some of them the admitted advantages of the electric vehicle are worth the price asked—to be more precise, the owners of less than 3 per cent. of the total registration in July, 1914, of vehicles in the States considered it worth while to pay the price, and this in the home of the "electric," where, according to President Smith, 98 per cent. of the automobile requirements can be taken care of by the electric vehicle absolutely.

No wonder that our American friends find the question of cheapening the first cost of the electric vehicle "some problem."

Censorship of Cable Telegrams.

In the last issue of the *Electrician* an extraordinary article appeared, in which we were made the subject of a bitter attack, couched in terms which transgressed the limits of good manners and verged upon abuse. The latter we shall pass over without further comment, but we cannot permit our contemporary's other remarks to remain unanswered.

The "short point" of the indictment brought against us is that in reproving the Commercial Cable Co. for objecting to the censorship of the U.S. Government we travelled beyond our "appointed field," and it is further suggested that in doing so we were endeavouring "to wipe off some old score." Regarding the innuendo thus conveyed, we may state at once and emphatically that we never had any "old score" to wipe off against the company, towards which we cherish no hostility whatever, and we are at a loss to imagine what gave rise to so unworthy a suggestion; moreover, we should scorn to permit our personal feelings to sway our judgment in such a matter. Our sole purpose in protesting against the action of the company was to serve the interests of our own country, which we considered likely to be prejudiced by such action. We are not concerned to justify our course in the eyes of our contemporary, which is welcome to its own opinion, but we are astonished that it should presume to define the limits of what it describes as our "appointed field." Harping on the phrase "electro-technical journal," our contemporary advances the proposition that such journals must confine their attention to matters of purely technical interest—apparently oblivious of the fact that its own columns exhibit numerous breaches of this novel regulation, and, in fact, the very next leaderette to the one we quote from treats of "Trading with the Enemy"!

We have never pretended to confine our attention to electrotechnical affairs, or to any other watertight compartment; we choose to survey the whole field of trade and industry associated with electrical engineering, and it is for us alone—with the good-will of our readers—to set bounds to that field.

We may add that we do not object to criticism, provided that it is sincere; but we do not accept as such that of our contemporary in this instance.

The relations of that journal to the telegraph companies are well known. We may point out that our leaderette was published on October 16th; 14 days afterwards we received a letter from the London manager of the company, which we published on November 6th, together with a note in reply, repeating our protest. The attack upon us in the *Electrician* appeared on November 27th—after an interval of three weeks.

The head office of the company is in New York, whence all important transactions are directed. The conclusion is obvious.

The Badge of Essential Industry.

It is to be feared that the public do not as yet generally realise that it is necessary for large numbers of workmen to be retained at home in order to keep our factories running. Reports from all parts of the country go to show that notwithstanding Lord Kitchener's statements and attitude toward industry, such men are being taunted for not having answered the call for recruits. It is not unnatural that the workmen should resent such taunts, and there is a growing demand for some form of badge that may be worn in order to indicate that the wearer is serving his country in this critical time just as much as the man in uniform. That this is the view of those at the head of our Admiralty and War Offices is shown by the official letters that have been sent to all firms and companies engaged on the production of materials for those departments. Thus, from the War Office, Lord Kitchener has sent out a letter, in which he says :—

I wish you to impress upon those employed by your firm the importance of the Government work upon which they are engaged. I fully appreciate the efforts which the employés are making and the quality of the work turned out, and I trust that everything will be done to assist the military authorities by pushing on all orders as rapidly as possible. I should like all engaged by your firm to know that it is fully recognised that they, in carrying out the work of providing the Army with supplies and equipment, are doing their duty for the King and Country equally with those who have joined the Army for active service in the field.

On behalf of the Navy, also, Mr. Churchill, in the House of Commons the other day, stated that "the Admiralty had been aided by the energy and determination of the workmen, who had strained their strength to the utmost, and who had by so doing made themselves the comrades of their fellow citizens who were fighting in the trenches."

In some departments of the iron and steel, engineering and other industries which are of first importance to the nation at the present time, there is already a marked scarcity of skilled labour, and while demands are so heavy from our own and our Allies' Governments, we might at least exercise a little discrimination in levelling our taunts of indifference.

In order to meet the wishes of their employés, so that they may be in a position to produce evidence to rebut any taunts as to their non-enlistment, quite a number of firms connected with the engineering industries, including, we believe, some associated with electrical engineering, have gone to the extent of issuing cards bearing on the back a copy of Lord Kitchener's letter, and, on the front, a reproduction in colours of the British flag, the name of the firm, and the words :—"Mr. —— is serving his country by using his best endeavours and work in connection with the manufacture of —— for the British Government." While such cards are useful to a certain degree, they only partially meet the requirements of the case, and it is suggested to us that the War Office and the Admiralty should undertake the issue of an official badge which workmen employed on the production of material for the Government can wear on their coats or caps, and so give an outward sign to the general public that, although not wearing khaki, they are none the less serving their Country.

It would, of course, be a matter for the Government authorities to decide whether such a badge should be uniform for all branches of industry or whether a special one should be prepared for each particular trade. So great is the need of such outward sign of public service felt in many quarters, that several firms connected with the motor and aviation industries, have, we hear, in addition to cards of the kind alluded to above, issued badges to their employés on the lines suggested.

Since the foregoing was written we have read in an evening newspaper that in Newcastle something like 30,000 men employed in factories are wearing such badges as are referred to above, with the permission of the War Office.

Copper.

The last few weeks have witnessed something like a transformation scene in the Copper market, and whereas a little while ago the future appeared to be steeped in gloom, the tone has become strong with active buying, and prices have moved up regularly day after day. The demand for the metal certainly underwent a notable expansion on both sides of the Atlantic, and holders were able to exact considerably improved prices.

The reopening of the London Metal Exchange to normal trading was, undoubtedly, a highly important contributory factor in the restoration of more usual conditions in the speculative and consuming trades. As regards the former, it is really wonderful how well the standard market held itself together under the absence of all interest on the part of the Continent, which, in times of peace, has been the great stand-by of brokers. As it is, the practical elimination of speculation on the part of the Continent has been scarcely felt, and the entire business passing has been on account of the home and American trades. It speaks well for the market that things should have so far reassumed their normal appearance at a time when the nations of the world were still struggling for the death grip.

Germany will, of course, be smashed for a generation or more, and the opportunities thereby presented to the other European industrial nations will not be lost sight of. Already energetic efforts are being made to extend the trade of British manufacturers in all kinds of metal goods, and there is little doubt that these efforts will be crowned by success. Belgium will rise as a phœnix, too, from the ashes of Termonde, Louvain and the rest of the ruined cities, and the consumption of the metals necessary to repair the havoc will give such an impetus to industry as has never been known in the history of the world. It is no use being too bearish on metals. Intrinsically they are not dear at present prices, and the possibilities are great. America at last seems to have turned the corner, and it needs only a very moderate improvement across the Atlantic to put a different complexion upon the markets as a whole.

There are distinct signs of betterment in the United States, and if these extend further almost anything might happen in the metal market. It is most reassuring that railway electrification schemes in the United States have not been summarily suspended owing to the unfavourable financial and industrial conditions ruling lately. The St. Paul Railway, for instance, has just let a contract for two million dollars' worth of electrification work to the General Electric Co., and this is only a portion of a contract for a 15-million dollar job, covering the electrification of the 430 miles of main track over the Rocky Mountains and Bitter Root divisions of the railway. It is very evident that a keen look-out must be kept upon electrification developments across the Atlantic. As regards Europe, the war demands for copper are, of course, enormous, but so far as the United Kingdom is concerned, the authorities have a good deal of the metal on hand, in the shape of copper seized as contraband, at various ports, notably, Gibraltar and Ardrossan. This metal is quite enough to enable us to go on comfortably for a few months, while apart from this we have the resources of the world at our disposal, whereas Germany must do the best she can with old metal and with what can be produced by her domestic mines, which last year produced about 25,000 tons. This does not go far. While the tendency of the market has been very firm with continued buying, there has been a slackening of prices within the last few days, which is nothing more than a natural reaction following upon the supplying of consumers' needs. Fundamentally, the position is quite satisfactory, but prices should not advance far because production is restricted by about 50 per cent., and when the time is ripe mines and smelters will be set to work at an increased rate.

OVER-PRESSURE PROTECTIVE GEAR FOR HIGH-TENSION CIRCUITS.

By KENELM EDGCUMBE, M.Inst.C.E.

(*Continued from page* 714.)

It is clear that neither the choking coil nor the condenser can alter the maximum value of the surge P.D. but only its form, and therefore a pressure limiting discharge gap (see next section) is essential. It is also advisable to take precautions as regards the insulation of the end turns of all machines and transformers connected to the line. If this is done, protection by means of discharge gaps and choking coils will be found to meet all possible requirements, and is almost exclusively used in the United States where the atmospheric conditions are exceptionally severe (see electrolytic arresters, below).

As to the best form of discharge gap to adopt, this question is more fully discussed when dealing with protective gear for internal disturbances, and it is shown that, all things considered, the horn discharger probably best fulfils the requirements, so that for the moment it will be assumed that this is the form of gap adopted.

Limiting of Damping Resistances.

Since any gap has a negligibly small resistance when discharging, it thus represents nearly a dead earth on the system, and consequently it is essential to insert a resistance in series with it. Such resistances, which are often spoken of as damping resistances, may take any of the following forms:—

1. Wire resistance immersed in oil.
2. Liquid resistance.
3. The aluminium cell (electrolytic arrester).
4. Carborundum rod resistance.
5. Carbon or carborundum powder resistance.

The oil-cooled wire resistance is somewhat expensive, and it must be borne in mind that when subjected to discharges the oil is continually getting hotter, so that although such a resistance has a fairly large heat capacity, with a prolonged discharge the oil runs a very great risk of being ignited and so starting a serious conflagration. Attempts have been made to minimise this danger by fitting a fuse or thermal relay, so arranged that if the temperature of the oil rises above a certain value the circuit is broken. Apart from the complication of such an arrangement it is obvious that so long as a current is flowing through the resistance it is performing a useful function, and to cut it out of circuit at such a time is to leave the line unprotected at a critical moment. A discharge resistance to be satisfactory should be practically indestructible even under prolonged discharges.

The liquid resistance is superior in this respect but has numerous defects of its own. It is messy, requires considerable attention if it is to be kept in good order, and unless carefully looked after is a source of danger. Should impurities find their way into the solution the resistance falls enormously, and it is always indefinite. If the discharge is of long duration the liquid will boil, emitting steam, which is deleterious and eventually breaks the circuit. Solutions of sodium carbonate or hydroxide (caustic soda) are usually employed for such resistances.

The aluminium cell, or electrolytic arrester, as it is usually called, deserves more serious consideration since it is so largely used in America, although in this country and on the Continent it has found but little favour. Fig. 6 shows such an arrester in section. It consists of a number of aluminium cones threaded one over the other with a small space between each, on insulating rods, the whole being immersed in oil. Into each cone is poured a small quantity of electrolyte, so that the pile forms a number of aluminium cells connected in series. It is well know that if a plate of aluminium is made the anode of an electrolytic cell a film of hydroxide will form and practically no current will flow. Consequently, if both anode and cathode are of aluminium and are subjected to an alternating current, the hydroxide will form on both poles and only a very small current will pass. So soon, however, as the voltage at the terminals of such a cell exceeds a critical value of say 350 volts the film breaks down and the resistance falls to that of the electrolyte alone. In practice the number of cells is so chosen that at normal voltage there is a potential difference of about 300 volts per cell. If the P.D., owing to abnormal circumstances, rises above the critical value the film breaks down and the energy is discharged to earth.

Unfortunately for the simplicity of the scheme, the continual passage of even the small current taken at 300 volts per cell causes heating and gradual dissolution of the plates, so that a gap in the circuit is essential, and for this purpose a horn gap is used. A further complication arises from the fact that when the cells are disconnected from the line in this way the film gradually dissolves off and the cells become useless. To obviate this it is necessary to "charge" them for a short time daily by connecting to the line. This is usually done by short-circuiting the horn gap by a metallic arm attached to an insulator. This charging operation must be performed daily, and although it does not occupy much time it is nevertheless a serious objection in the case of a widely scattered area.

From what has been said it will be seen that so soon as the film has broken down under a discharge the resistance to earth is extremely small, being in fact only that of a comparatively short column of electrolyte. As a result, what amounts almost to a dead earth is thrown on the line and, although this may occasionally be justified by the severity of the disturbance to be dealt with, in most cases it is not, and the arrangement shown in fig. 7 is, consequently, employed. In this figure H^1 and H^2 re-

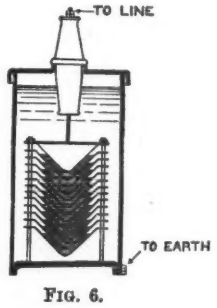

Fig. 6.

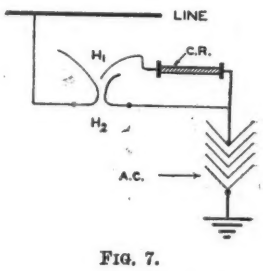

Fig. 7.

present horn gaps, H^1 being set more finely than H^2. As soon as H^1 sparks over a comparatively small current flows to earth through the carborundum rod resistance C.R. If the P.D. is higher still, the gap H^2 breaks down and the line is dead earthed through the aluminium cells (A.C.). A danger with this arrangement is that the rod resistance (see below) is liable to break down without warning and thereby to open-circuit the finely set horn, thus leaving the line unprotected except against exceptionally severe overpressures. It is, moreover, difficult to tell from an inspection of the rod that such a breakdown has occurred.

An advantage claimed for the aluminium arrester is that it does not act merely as a damping resistance but, itself, breaks the circuit in half a period, in much the same way as does an oil switch. As a severe disturbance almost always lasts much longer than this, however, the advantage gained would seem to be small. On the very long overhead transmissions which are common in America the

aluminium arrester has performed useful service, and if well looked after it is valuable in such cases, but for any other purposes has less to recommend it.

The carbon or carborundum rod resistance which has already been alluded to was at one time largely used, particularly in America, but is useless for any except quite moderate discharges. Owing to its small heat capacity anything like a heavy discharge causes overheating and partial disintegration. This is followed by still further local overheating until in a short time the circuit is opened altogether. Unfortunately there is no external evidence to show that this has happened, so that no reliance can be placed on such resistances.

Carbon or carborundum powder resistances.—The powder used consists of carborundum or carbon mixed with some insulating material such as powdered fire-clay. As usually constructed, the powder is placed in a vertical stoneware pipe having contacts at top and bottom, the former being connected through a discharge gap to the line and the latter direct to earth. The drawback to such a resistance is that with continual heating and cooling due to discharges the weight of the powder causes it to settle down into a more or less compact mass, the ohmic resistance continually decreasing so that no definite value is adhered to.

In the *Brazil carbon powder resistance* on the other hand the vertical construction has been abandoned altogether, in favour of a horizontal fire-clay slab having a suitably shaped groove which is filled

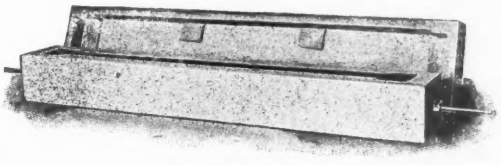

Fig. 8.

with the special carbon powder. Fig. 8 shows such a resistance. It consists of a long narrow fire-clay trough with carbon terminal blocks at each end into which are fixed connecting rods provided with clamping nuts. A cover, also of fire-proof material, protects the powder from disturbance.

Such resistances being constructed entirely of fire-resisting material will carry heavy or prolonged discharges without danger, and will, moreover, maintain a resistance which may be regarded as constant for all practical purposes. Fuller details of the Brazil resistances are given later in connection with resistances for dealing with internal over-pressure discharges.

Over-pressures due to Internal Disturbances.

The origin of such over-pressures was very fully dealt with by Mr. Duddell in his presidential address and a brief reference here will suffice. The main causes of these disturbances are:—

1. *Resonance.*—It can be shown that for resonance to occur in the case of an alternator feeding a cable the capacity current of the cable must be equal to the short-circuit current of the alternator. Since the latter will be some 2½ times that corresponding to full load, it will be seen that resonance in such a case is practically impossible. At the same time resonance with a 3rd or higher harmonic is shown by Mr. Duddell to be quite possible. Petersen has further pointed out (*E.T.Z.*, Vol. 25, p. 626, 1914) that if a 3-phase generator is shorted on one phase, harmonics are produced between the healthy phases, having amplitudes of sometimes as much as 50 per cent. of the fundamental, so that very serious resonance may occur even although the circuit is considerably "out of tune." An earth on one phase will have the same effect. Again, Mr. Duddell has shown that in the case of transformers or other plant fed through long cables resonance with the fundamental wave often occurs. Thus, even with the excellent wave forms given by modern machines, protective gear for dealing with resonance is essential.

2. *Switching operations, including sudden changes of load.*—A change in the load conditions at any point must inevitably be followed by a re-adjustment throughout the whole system. Whether this readjustment is attended by untoward results or not depends upon the magnitude of the change and the conditions under which it takes place, and Mr. Duddell has shown that there are a number of cases in which very dangerous pressure rises are caused in this way.

When, for example, an inductive circuit (*e.g.*, a transformer or motor) is suddenly switched in, a concentration of potential on the end turns occurs in precisely the same way as that described when dealing with overhead atmospheric surges, and much damage to transformers and generators has been caused in this way. If, on the other hand, an inductive circuit is suddenly broken it is well known that a very considerable rise of pressure occurs. When, again, a capacity is suddenly switched in a rise of pressure will follow owing to its being "over-charged." This has been the cause of many cable breakdowns, and is sometimes avoided by means of so-called cable charging resistances. A similar rise may occur on an overhead line where the wave is reflected by the open end of the line. In both cases the rise may be very much increased by a chattering of the switch contacts. In fact, should the second contact occur at the peak of the wave, a rise to nearly four times the normal may ensue.

A still more serious rise may occur when a circuit, consisting of capacity and self-induction in parallel, is broken. Such a circuit may be formed by the generator winding and the capacity of a cable, which is suddenly opened at the further end. Fig. 9 illustrates this, G.W. representing the winding of a generator (for simplicity assumed to be single phase), C the capacity of the cable, and B

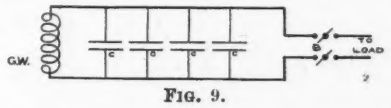

Fig. 9.

a breaker controlling the load. Should this breaker open while a heavy current is flowing the energy stored in the self-induction of the generator winding is transferred to the capacity of the cable. In order that the latter may absorb all the energy its terminal voltage must necessarily rise very considerably above the normal. The capacity having been charged in this way will again discharge through the self-induction, the process repeating itself until the energy has been dissipated in heat.

Still another cause of rises in pressure in an unloaded line is the Ferranti effect. In this case a wave travelling along a line is reflected at the open end, and sent back along the line, the length of which is such that it reaches the generator end exactly half a period later. At this instant the generator is ready to re-dispatch it, with changed sign, to the far end where it is again reflected and the process repeated, thus building up a pressure at the far end, the maximum value of which would be unlimited but for the losses involved.

3. *Faults* whether between lines or to earth give rise to over-pressures of a similar nature to those just mentioned, with this difference—that while in switching operations precautions can be taken to minimise the disturbances, in the case of a fault not only are no such measures possible but the magni-

tude of the current to be dealt with is usually greater; moreover the arc which accompanies a fault has great instability, and by the suddenness with which the circuit is broken, enormously increases the severity of the resulting over-pressure. It was shown by Mr. Duddell that the instability of such an arc is much augmented if shunted by a capacity—a condition often fulfilled in practice owing to the capacity of the cable on either side of the fault.

The sudden breaking of the fault current in this way is almost the same in its effects as the sudden release of the "bound" atmospheric charge illustrated in figs. 1 and 3. That is to say, a steep-fronted wave rushes along the line in both directions with a velocity approaching that of light and is accompanied not only by a rise of pressure when reflected, but causes serious trouble through the breakdown of the end turns of windings in the manner already dealt with (see fig. 4).

Again, on an insulated system, an earth fault will for some time give a sparking earth with the result that oscillations accompanied by a serious rise of pressure will take place in the circuit formed by the capacity of the line and the self-induction of the generator or transformer feeding it.

(*To be continued.*)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Ediswan Door Heater.

One of the most prolific sources of cold draughts is the space under the average door, from which a current of cold air usually sweeps across the floor.

A most ingenious patented arrangement has now been introduced by the Edison & Swan United Electric Light Co., of Ponder's End, Middlesex, which should go a long way to remedy this very usual trouble. It consists of an electric heater which is attached to the lower edge of the door, and thus warms up the air entering beneath the latter. The heater contains four Ediswan Quartzolite elements; these are coupled by flexible to an adjacent plug and socket on the wainscoting, and an automatic switch can be provided to cut off the current when the door is opened. The heater is attached by two screws, and can be supplied for letting into the bottom of the door flush with the front surface. Fig. 2 explains the method of installation.

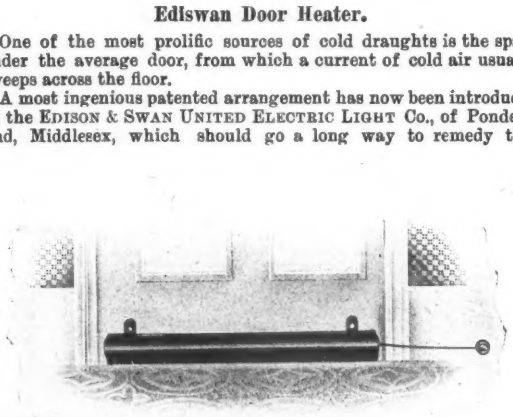

Fig. 1.—Heater attached to Door.

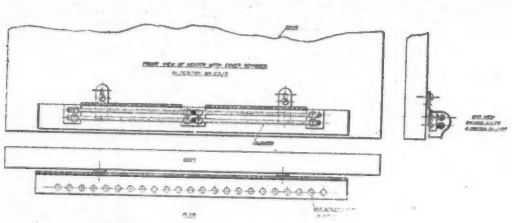

Fig. 2.—Details of Door Heater.

The "Linisher" Surface Grinder.

Messrs. Robt. H. Lash, of 31, Carburton Street, W., send us particulars of the "Linisher" patent surface grinding machine, which follows generally on the lines of one or two machines already described in these columns.

The "Linisher" consists of an endless grinding band driven by a pulley at one end and provided with a tension pulley underneath to take up slackness. Special bands are supplied woven in one continuous piece, and the upper half of the band runs over a machine ground table, which can be adjusted laterally while running, so that the band runs on the centre of the table or the extreme edge—the latter position being valuable for polishing up to corners.

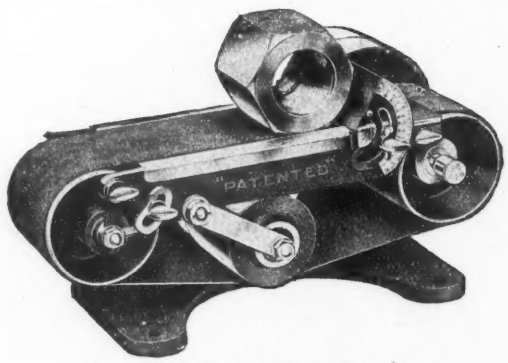

Fig. 3.—Linisher Surface Grinder.

Patent quadrants are fitted to enable the pulley centres to be adjusted to allow for unequal stretch of bands, and a graduated adjustable grinding rest (patented) is fitted to enable the unskilled operator to grind work accurately at any required angle. Fig. 3 illustrates the machine, type A, which is fitted with a table of about 10 in. × 5½ in., and weighs 56 lb. Large machines are also supplied.

Simplex Watertight Lampholder.

We illustrate in fig. 4 a galvanised watertight lampholder which has been introduced by Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C. The holder is substantially built and provided with a drainage lip which effectually carries the drip water clear of the lampholder shell; the length of thread has been increased to about ⅝ in., and on the shade-carrier pattern an improved method of attaching the shade has been incorporated. The figure shows the plain pattern. The holder is particularly adapted for use in exposed situations.

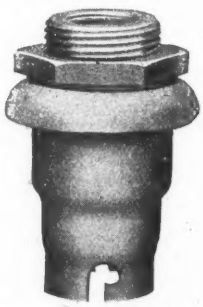

Fig. 4.—Simplex Watertight Lampholder.

Belling Griller-Boiler.

Messrs. Belling & Co., of Derby Road, Edmonton, are introducing a new griller-boiler, which we illustrate in fig. 5. This is built up in cast-iron with hinged back and front doors to allow of easy cleaning, and is fitted with a drip tin and grid. The griller is heated by four standard Belling fire-bars (2-kw. loading) with three-heat control, the "low" position being for use when the griller is closed up and used as an oven. The griller oven measures 12½ in. × 8½ in. × 7½ in. high.

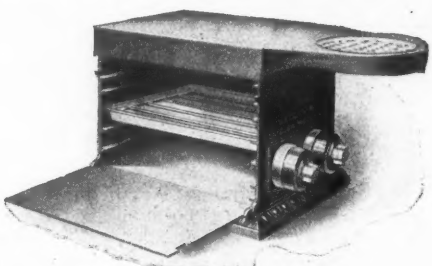

Fig. 5.—Belling Griller-Boiler.

The boiling ring is loaded with 1½ kw. with three heats; it is 6 in. in diameter and fitted with redhot elements. The apparatus is

claimed to be a complete breakfast cooker—an electrical duplicate of a most successful gas appliance. It will boil the kettle on the ring, and heat plates, milk, porridge, &c., on the top of the grill while the bacon and toast are being cooked inside.

A New Mining Switch.

Messrs. Scholey & Co., Ltd., of 151, Queen Victoria Street, E.C., have lately put on the market the Scholey-Cantie gravity combined switch and fuse, which possesses some interesting features. It is simple and reliable, having no delicate or flimsy parts. The contacts are mounted on an insulated base which slides on two vertical rods; at the top and bottom of these rods are springs, the action being such that when the switch is opened the top springs accelerate the movement of the contacts as they fall by gravity to the off position, the two bottom springs acting as a buffer. The break and make are instantaneous. The handle operates the sliding contacts through a toggle joint, the action being rapid and positive. The switch is fool-proof, it being impossible to open the cover unless the switch is at the off position, or to close the cover if the switch is at the on position.

Fig. 6.—Scholey-Cantie Combined Switch and Fuse.

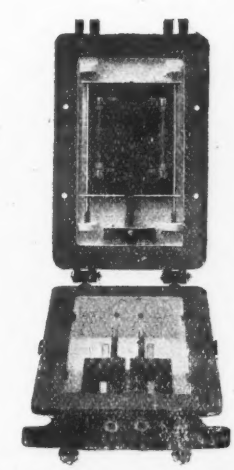

Fig. 7.—Switch Case Open; Switch in the "On" position.

Enclosed fuses are used; the leading-in cables pass straight to the terminals. The switch is enclosed in a flame-proof iron case with wide flanges.

Electric Cooking at the Brighton Royal Pavilion.

As many of our readers are aware, the celebrated Royal Pavilion, at Brighton, has been taken over by the War Office authorities for the accommodation of wounded soldiers, and already over a hundred of our Indian troops are being treated in the Dome, which has been converted into a temporary hospital.

The Royal Pavilion was erected by King George IV when Prince of Wales, between the years 1784 and 1787, and was used by him and his successors as a marine residence until 1850, when it was purchased by the Brighton Town Commissioners. It has since been the venue of numerous public and private functions.

The new plant which has been installed for the Corporation under the supervision of Mr. John Christie, the borough electrical engineer, was supplied by the Carron Company, of 15, Upper Thames Street, E.C., and consists of one range with two roasting and baking ovens, each 20 in. wide, and one 40 in. wide × 18 in. deep and 24 in. high inside; these are heat-insulated and lined with porcelain-enamelled steel sheets. Each oven is fitted with hinged shelf racks, grids, sheet-iron drip tray and meat hook, all removable for cleaning.

The heating elements fitted at top and bottom are mounted in cast-iron frames, removable by simply sliding out, the contact being automatically made at the back well away from the heat of the oven.

This type of element greatly facilitates cleaning, while the wiring is carried in cast-iron channels clear of the oven to main terminal boxes mounted on the back of the ovens. Each element (top and bottom) is wired for series-parallel control, so that the smaller oven has six ranges of current consumption and the larger one 12.

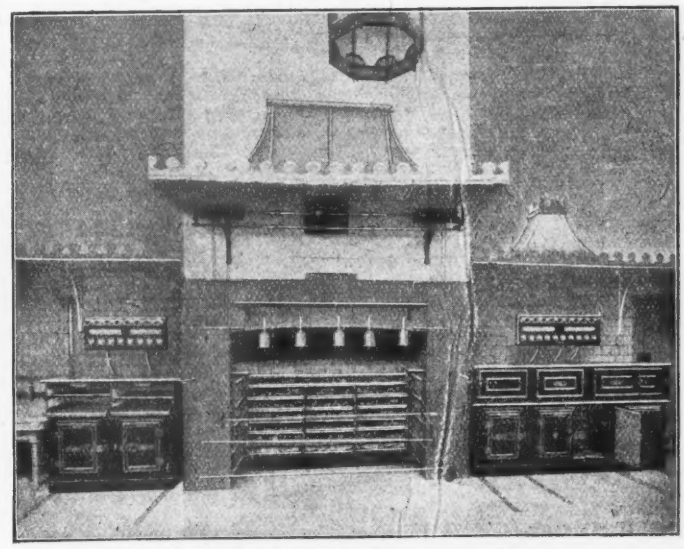

Fig. 8.—Carron Ovens, on either side of Coal Fire.

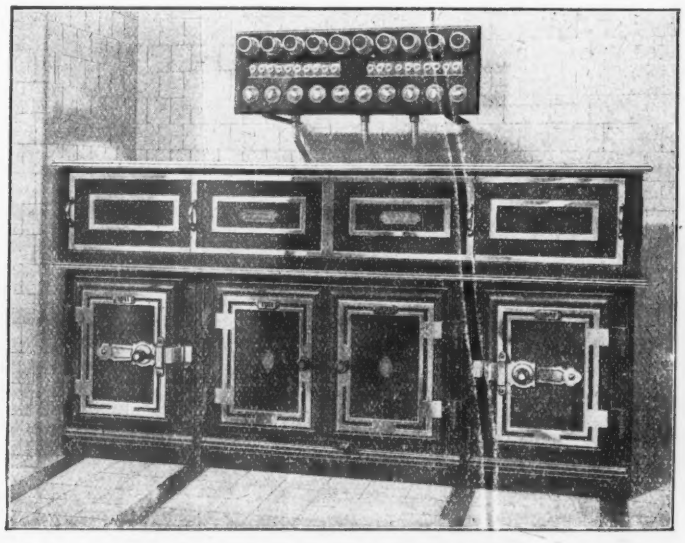

Fig. 9.—Range of Carron Ovens.

The top heat gives excellent results with pastry.

Over the oven is a hot closet with sliding doors, subdivided in the centre, and each half separately heated and wired for series-parallel control.

A switchboard is provided, fitted with indicating rotary series-parallel switches, Zed fuses to each pole and a pilot light to each circuit—a marked ruby disk showing which circuit is in use. The loading of each oven is 3,500 watts, and of each half of the hot closet 1,000 watts, giving a total of 16 kw. The approximate overall length of the range is 8 ft. 6 in., and its height 4 ft. 3 in.

Another range supplied contains two 20-in. wide ovens similar to those mentioned. Over them is mounted a double grill,

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white porcelain enamelled inside, supplied with a rod brander and tinned copper drip-tray shaped to drain to a deep well in front, ensuring the collection of fat away from the heat.

Each chamber is heated by standard Carron elements mounted on a cast-iron sliding frame, removable from the front. The wiring and switchboards are similar to those of the other range.

Each oven is loaded with 3,500 watts, and each half of the grill with 6,000 watts, making a total of 19 KW.

The apparatus is black enamelled, finished with ground facings, and earthing terminals are provided.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Willesden Workhouse Supply.

The report in your last issue relating to the supply of electrical energy to the Willesden workhouse may be very misleading to technical readers, and it may interest you to know a little more of the actual conditions.

For the last complete year preceding the contract with my Council for the supply to the Guardians, their own supply cost them, according to their own figures, £421 11s. 10d., and this after an allowance of ½d. per unit (on 44,701 units), for the value of the exhaust steam coming from the electrical plant which was used for heating purposes in the infirmary.

The figures for one complete year's supply by the Council are not at the moment available, but will not exceed £220, which is in round figures, £200 less than they admitted the cost to be during the previous year by their own plant.

Incidentally, the taking of the supply from the Council's mains avoided the recommended purchase of the new battery which would have incurred a total annual cost of approximately £150 when capital and maintenance charges with the units lost in the battery, based upon their own previous works cost, are included.

How the alleged loss of £363 is arrived at under these circumstances many would be interested to know. The only reason put forward by the Guardians is that they have lost the heat value of the exhaust steam which, according to their own figures two years ago, was worth ½d. per unit, while they are now endeavouring to claim a value of something like 2d. per unit, but doubtless the "more efficient" test they propose to make during the next 12 months will do something towards clearing up the mystery surrounding the alleged miraculous value of their exhaust steam.

A. W. Blake,
Electrical Engineer.

Willesden D.C. Electricity Department,
November 28th, 1914.

Trading with the Enemy.

Your leading article in the current issue is very interesting, and a few ideas have occurred to me which should receive careful consideration as affecting the electrical trade of this country generally.

Most electrical firms have gone through the usual quiet summer season, and profits or commissions have been comparatively small in consequence.

At the very time when we were all looking forward to the electrical season opening out, we were unavoidably plunged into the horrors of war, which seriously affected trade and finance for some weeks, and made headway difficult—our rents and debts have got behind owing to our inability to get money in to pay our own countrymen.

As soon as the moratorium has come to an end we are threatened with proceedings by "British firms" with alien shareholders; such proceedings have been taken, and judgments given in their favour. It is not right that these firms should be allowed to go into our Courts and obtain judgments and executions, and thus steal a march on our British firms who are allowing extended credit, and, in many cases, supplying further goods on credit, and, in fact, loyally helping their fellow countrymen all they possibly can; amongst my numerous trade friends I don't know of one that has been proceeded against by an English firm so far.

In conclusion, there is only one nation on which we can throw the onus of this deplorable fracture in trade and finance, and that is Germany: therefore is it not our duty to help those who are helping us first? The enemy should never have been allowed to hurl this new and powerful weapon at England through the medium of our Law Courts.

Fairplay.

Cardiff, *November 28th*, 1914.

Re Notes on Modern Continuous-Current Motors.

I waited for an abler pen than mine to comment on the above article, and even hoped that a designer might be found who would come forward and enlighten us on some of the points raised. I recently wrote upon the same subject ("The Modern Motor," ELEC. REV., April 10th, 1914,) and stated an opinion that I still hold, namely—that the designer suffers from lack of operative experience. If these gentlemen had to run the motors they design, we should soon get machines much more handy and get-at-able without any increase in price. Unfortunately, until lately there has been no medium excepting that of the technical Press, in which the designers, manufacturers and those who have to install and operate electrical machinery could be brought into touch with one another. This has been overcome, I am glad to say, by the newly-formed "Association of Supervising Electricians," which numbers amongst its members, ordinary and honorary, some of the leading men of the trade, both on the installation and manufacturing side.

It has already proved of value to the manufacturer. In one case, a well-known make of main switch was submitted for criticism and suggestions. As a result it was placed upon the market in a much improved form. At such a time as this, when new and better designs are necessary in order to obtain our share of foreign trade, an Association where the manufacturer can get into touch with those who have to handle his products, and know the directions in which the aforesaid products can be improved, should supply a much-felt want.

Ernest F. Butler.

London, W.C., *November 30th*, 1914.

LEGAL.

THE OSRAM LAMP WORKS, LTD., *v.* CORONA LAMP WORKS, LTD.

AN application was made on November 26th to Mr. Justice Sargant, in the Chancery Division, that this patent action might stand over until after the termination of the war.

MR. MARK ROMER, K.C., who made the application on behalf of the defendants, said that the case was nine out of that day's list of cases for trial, and his application was really a renewal of an application made on October 16th.

His LORDSHIP: Does anyone oppose the application?

MR. WALTER, K.C., representing the plaintiffs: Most certainly we do.

MR. ROMER said that the plaintiffs were suing on two patents and were claiming an injunction, but what they were really asking for was damages or profits as the particular process covered by the patent had been given up, he understood, by the plaintiffs themselves, and the process alleged to be an infringement was no longer used by the defendants.

His LORDSHIP: Will the defendants then undertake not to use this process.

MR. ROMER said he was told so. There could be no hurry about the matter. The action was started so long ago as December 12th, 1912. The statement of claim was delivered early in 1913, and the defendants particulars of objection were given in March, 1913. The plaintiffs obtained an order for the inspection of the defendants' process on December 13th, 1913, and that inspection took place on three dates in February and March, 1914. Notice of trial was not given until July 30th, 1914, five days before the outbreak of the war. The defendants had prepared expert evidence by Mr. Peter Saby, Dr. Awfrecht and Mr. Oswald Wachsmuth. They had considered the matter very carefully and had come to a conclusion as to how the defendants' evidence ought to be presented at the trial. They were three German gentleman, and were, therefore, not now available. The defendants' evidence must necessarily come from Germans, because the process which was patented or alleged to be patented for the manufacture of metallic filaments had been developed in Germany. The people who knew most about it were the Germans. Large sums amounting to about £1,000 had been paid to those experts, and a further sum of about £1,000 had been spent in investigating their experiments, and their evidence was no longer available. Even if it were possible to obtain the necessary experts in England, the defendants would have to pay them large sums of money, and that already expended would be thrown away, besides which, it was almost impossible to get them. It was really an Austrian and German process for the use of tungsten as an incandescent body for electric lamps, and they had no first-hand knowledge in England. The defendants' case could not be fairly and properly put to the Court unless they could obtain the evidence of these German experts. The process was that of obtaining a metallic filament by squirting, which has been superseded by a later invention known as the drawn-wire process. The defendants had not made any of the squirted filaments for the last 18 months, and had no intention of doing so.

His LORDSHIP asked whether they were willing to give an undertaking to that effect.

MR. ROMER said yes. Even if they could obtain the necessary witnesses in this country, they could not be ready for trial for some time, owing to the large range of scientific experiments that had to be dealt with in the action. For the experiments tungsten acid was necessary. They had tried to purchase some from America, but had not been able to do so.

MR. WALTER said this was nothing more than a renewal of the application made and refused on October 16th, and on the same evidence as then.

MR. JUSTICE SARGANT thought the evidence was much stronger now than it was before.

MR. WALTER said that to postpone this trial now would be to inflict great hardship on the plaintiffs. With regard to the difficulty of

getting English witnesses, they could supply the defendants with the names of persons who knew more about the matter than any German, and with regard to their chief ground that they could not get the stuff, the plaintiffs had obtained it that morning at three places.

Mr. Justice Sargant pointed out that it would be very unfair to force the defendants to trial if they could not get proper evidence in the time, or to cause them to throw away the £2,000 they had already expended.

Mr. Walter said the plaintiffs had prepared for trial, and he had been in consultation with his learned friends, Mr. Colefax, K.C., and Mr. Gray, who appeared with him. The trial had been fixed not to come on before December 2nd, but he submitted it ought to come on as soon after that as possible.

Mr. Justice Sargant said that the defendants had evidence that none of the people from whom they had obtained it had any of this tungsten acid left—it was a special form of tungsten acid made in Germany; that they were unable to obtain expert evidence in this country; and that it would take an English expert, if found, several months to qualify to give evidence. Had the defendants any evidence to rebut that?

Mr. Walter said he had not come prepared with evidence of that kind, but there was no evidence that the defendants had approached any English experts at all.

Mr. Justice Sargant said he had to deal with the matter on the evidence.

Mr. Walter said then he would put in an affidavit that any number of persons could be found qualified to give evidence who had not been engaged by the plaintiffs. His Lordship was being asked to say that the plaintiffs should be deprived of their rights because the only persons who could give evidence in this case were Germans.

His Lordship said he must give the plaintiffs an opportunity of putting in evidence in answer to the application on the points he had mentioned, and for that purpose he would adjourn it for a week.

British Thomson-Houston Co., Ltd., *v.* Duram, Ltd.

Mr. Justice Neville, in the Chancery Division, on Friday, November 27th, heard a summons taken out by the defendants in this action, asking that the plaintiffs should be ordered to give them discovery of their books.

Mr. T. Terrell, K.C. (with him Mr. Courtnay Terrell), who appeared in support of the summons, said the patent in question was No. 21,513, of 1906, and related to the tungsten used in the manufacture of electric lamps. The plaintiffs were suing in respect of alleged infringement, and the defendants besides denying the validity of the patent and infringement had pleaded that the patented process was carried on mainly outside the United Kingdom, namely, by the General Electric Co., of New York, the Westinghouse Electrical and Manufacturing Co., of Hartford, Connecticut, the Franklin Electrical Co., the Allgemeine Elektricitäts Gesellschaft, of Berlin, the Siemens & Halske Aktien Ges., and by other companies in Holland and elsewhere. They had been called upon for particulars and had given full particulars of these matters. That being so, he did not see why an order for discovery should not go as a matter of course. They were the defendants in the action and were asking for discovery of the documents against the plaintiffs as part of their defence.

Mr. Walter, K.C., for the plaintiffs, said that what the defendants were really asking for was a full disclosure of the plaintiffs' trade. This was a new defence set up under Sec. 25 of the Patent Act, of 1907, and it incorporated a good deal of Sec. 27 about which there had been a good deal of discussion about the discovery of documents. The sections really related to an application for the revocation of a patent on the ground that the patented process was not worked wholly or mainly in the United Kingdom. His submission was that it was not the intention of the Legislature that the claimant for revocation should be given the right to go into the relations between the manufacturer here and all and sundry in every other place. A sort of Star Chamber was set up by the Comptroller, and on its being alleged that an article was manufactured mainly or exclusively abroad, the Comptroller called upon the patentee to give full particulars of all the competitors in his business. Such procedure would, however, be held to be absolutely contrary to the intention of the Act. Every application under this section had been made by Germans with the idea of contesting the patent so that they could import the article into this country. The section was open to great abuses, for the unfortunate patentee, when anyone pleaded the section, had to disclose his books to a person who was probably a competitor in his trade. He submitted that the present time was not the time for any such discovery as was sought in this case. The defendants really relied for their defence on the fact that the process of manufacture described and claimed in the patent was and had been since the date of the said letters patent, carried on mainly outside the United Kingdom, and in their particulars they mentioned several firms. But these firms were not agents for the British Thomson-Houston Co., who manufactured these lamps at Rugby. These foreign firms had nothing to do with the plaintiff company. It was quite easy for anybody, with or without accurate knowledge, to give the names of a number of persons abroad who manufactured these lamps. They could find them in the Directory. The plaintiffs had no business at all abroad, and the sole object of this order for discovery was to obtain the whole of the trade books of the plaintiffs with the number of lamps manufactured by them. In an ordinary patent action the Court never ordered a defendant to produce his books, and he submitted that in this case no order for discovery ought to be made.

His Lordship, in giving judgment, said that it was always hard on a litigant who in the end proved to be in the right, to have an investigation into his affairs which his opponents had no right to obtain by means of the litigation. That went to the root of discovery, but it was an inconvenience that they submitted to if they were to have discovery at all, which it was the practice of that Court to give. He thought if he were to refuse discovery of documents in this case, he would have to refuse all discovery in all cases where such matters were raised by a patentee. The order for discovery would therefore go, and costs of the summons would be costs in the action.

Mr. Walter said this was a very important matter, and he asked for leave to appeal.

Leave to appeal was granted.

Miller *v.* Telford, Grier & Mackay, Ltd.

Before Lord Dewar, in the Court of Session, the record was closed in an action at the instance of Charles Miller, Edinburgh, against defendants, electrical engineers, 222, Broomielaw, Glasgow. The pursuer, who claims £500 in respect of personal injuries, was in the employment of a firm of makers of lifts and cranes, and was in July last engaged in fitting up a lift in Aultmore House, where defenders were engaged in fitting up an electrical installation. While he was working in the shaft of the lift, pursuer says, some workmen in the employment of the defenders began work at the top of the shaft. He avers that the latter were warned to be careful in their operations, in the course of which they dropped down the shaft a brick, which fell upon the pursuer's head and seriously injured him. Pursuer attributes fault to the defenders, who deny liability and plead contributory negligence. They state that the pursuer was aware of the fact that their workmen were working at the top of the shaft, and also of the nature of the operations, and was thus advised of the danger he ran in continuing to work at the bottom of the shaft. Issues were ordered for the trial of the action by jury.

Telegraphists' Cramp.

In the City of London Court, on Monday, an interesting point was raised under the Workmen's Compensation Act when George Harrison, telegraphist, made a claim against the Associated Newspapers, Ltd., Carmelite House, as proprietors of the *Daily Mail*, to recover compensation for having sustained an attack of telegraphists' cramp while working for them. The respondents brought in W. C. Leng & Co., Ltd., as the proprietors of the *Sheffield Daily Telegraph*, as third parties, and claimed 25 per cent. contribution from them because Harrison came from them to the *Daily Mail*.

Mr. Pocock appeared for the applicant, and Mr. Ellis Hill for the Associated Newspapers, Ltd., and Mr. Berryman for W. C. Leng & Co., Ltd. Dr. Thompson, one of the Home Office medical referees, sat with Judge Rentoul, K.C.

Harrison's case was that he contracted the cramp while working on the *Daily Mail*, but he was not aware at the outset what he was suffering from. It was diagnosed first of all as muscular paralysis, and he received some benefits under the National Insurance Act. In December, 1913, he was advised that it was telegraphists' cramp, and that he should apply for compensation under the Workmen's Compensation Act, which he did. He was employed by the *Sheffield Daily Telegraph* as a telegraphist from May, 1910, to December, 1912, when he went to the *Daily Mail*, working for them until September, 1913, when he left as he could not work the telegraphic instruments. The *Daily Mail* had paid him £1 a week from September, 1913 to September 25th, 1914, and it was then stopped. His wages had been two guineas a week. He worked the Wheatstone perforator, the Gell perforator, and the Morse key at the *Daily Mail*. There were manifestations of the cramp before he left the *Sheffield Daily Telegraph*. He went there as a boy in 1904; but he did not work the Gell perforator there. He had done no work since he left the *Daily Mail* because they promised to find him other work, and they had not done so. He worked considerably harder for the *Daily Mail* than in his previous situation, though his hours were the same, but the previous salary was 30s. a week. He had been fit for any other than telegraphist's work since March. He expected the *Daily Mail* to bring it to him rather than he should go for it.

Dr. Cowen said that Harrison could not follow his occupation as a telegraphist. He, no doubt, suffered from the premonitory symptoms a long time before the actual cramp appeared. The Gell perforator would not produce the cramp by itself.

For the *Daily Mail*, Dr. T. Grainger Stuart, F.R.C.P., now serving as a captain with the New Army, said he had seen the instruments complained of worked by Harrison at the *Daily Mail* office. He soon became quite incapable of manipulating them. His condition must have been coming on for two or three years before he began working for the *Daily Mail*.

Dr. W. E. Lee, F.R.C.S., M.D. Lond., for the *Sheffield Daily Telegraph*, said that Harrison did not complain of feelings of cramp while working for that paper. His present condition was due to his more continuous work on the *Daily Mail* for nine months, as against his several years of less strenuous work on the *Sheffield Daily Telegraph*. There were more intervals of rest at the *Sheffield Daily Telegraph* than at the *Daily Mail*.

Mr. Alf. Inwood, London Editor of the *Sheffield Daily Telegraph*, said that Harrison never complained to anyone on the paper of cramp. He was engaged as a wooden slip puncher, and was a

very good hand. Had he shown any signs of cramp when he left, the *Daily Mail* would not have taken him on. Any telegraphist could tell if a man was working properly or not. The Gell machine was a comparative innovation as far as newspapers were concerned. The field of Press telegraphists was so limited that they generally knew all about the workers.

PHILLIPS, the chief telegraphic operator of the *Sheffield Daily Telegraph*, said that Harrison was one of the finest "punchers" in Fleet Street.

MR. BERRYMAN observed that the compensation was recoverable from the employer, who had employed the worker for the 12 months before the cramp was discovered. He had been brought there as a respondent as well as a third party.

JUDGE RENTOUL held that Harrison was still incapacitated and must go on receiving the £1 a week, of which the *Daily Mail* was to pay three-quarters and the *Sheffield Telegraph* one-quarter. Those contributions would date back to the date of the accident, and the costs would be arranged in the same way as the compensation. If the *Daily Mail* could not get Harrison work it was certain he could not have got it for himself.

MOYLE & WING *v.* ADNIL ELECTRIC CO., LTD.

IN the City of London Court, on Tuesday, before his Honour Judge Atherley-Jones, K.C., Mr. S. H. Moyle, 127, Endlesham Road, and Mr. R. W. F. Wing, Great Dover Street, Borough, formerly carrying on business in partnership, J. S. Moyle & Son, Ltd., and J. J. Windsor & Co., Ltd., Broadwall, Blackfriars, made a claim against the Adnil Electric Co., Ltd., Artillery Lane, electrical engineers and manufacturers, for £71, or the return of a 16-H.P. electric motor wrongfully detained by the defendants, valued at £65, and £6 damages for its detention.

Mr. Grey appeared for the plaintiffs, and Mr. Clements for the defendants.

MR. CLEMENTS told the Court that the motor was sent to the plaintiffs for repair, and, in the ordinary course of business, defendants sent it to Berlin to the makers, for whom defendants were the agents in London. After the outbreak of war the motor was stopped on its way back, and defendants could not return it. They did not know where it was, although the Berlin firm had sent them the invoice. Plaintiffs knew defendants would have to send the motor to Berlin. They made an estimate to repair the motor in London for £21, but as it could be done in Berlin for £16 10s. they sent it there. It was an Adnil motor made in Berlin 12 years ago. Plaintiffs had bought it at auction.

JUDGE ATHERLEY JONES, K.C., *observed it was a matter of common knowledge that with nearly all electrical work Germany had the monopoly.* [The italics are ours, of course. What bearing has this remark on the case? And where do judges get their *common* knowledge?—EDS. E.R.]

MR. CLEMENTS: They are attempting to charge us £65 for an old motor when a new one can be supplied for £30.

JUDGE ATHERLEY-JONES remarked that it was evidently the stress of war that prevented defendants from returning the motor.

MR. GREY said that defendants had refused to supply them with another motor in substitution for the lost one. Plaintiffs did not know that the motor was to go to Germany. It ought not to have been sent there. Defendants must take the risk of that as war had broken out.

Ultimately the case was compromised by the defendants agreeing to give plaintiffs a new motor, no costs on either side.

ELECTRO-STEEL FOUNDRIES, LTD.

A PETITION for the compulsory winding up of this company came before Mr. Justice Neville, sitting for the disposal of companies winding up business, on Tuesday, December 1st.

MR. BISCHOFF, who appeared in support of the petition, which had been presented by Mr. A. E. Owen, a shareholder, said that it had been presented owing to a state of circumstances that had arisen through the war. The company was formed in June of this year for the purpose of foundering and carrying on, at Darlaston, an electric foundry in accordance with methods adopted in Germany. The original arrangements were made by one Englishman—the petitioner—and two Germans. An agreement was entered into on July 22nd, 1914, between the company, the two German gentlemen and Mr. Owen, under which a German company with which the German promoters were connected were to supply drawings and assistance for the carrying on of the foundry. They were to subscribe for £10,000 shares, which, according to the articles, were to confer the right of nominating four directors. Under that power two German gentlemen were nominated as the first directors. By the same agreement the petitioner Owen agreed to sell to the company the land upon which the foundry was to be built and to take up £20,000 of the shares, which were to confer upon him the right of nominating four directors. Under those powers he nominated himself and Mr. Borland, a Swiss. At a meeting held the same day the shares were allotted, and a call of 5s. per share was made, but was not payable until August 5th. In the meantime, war intervened and upset all the arrangements of the company. The two German gentlemen were in Germany, and the German company was, of course, unable to render any assistance. It was necessary, under these circumstances, that something should be done in England to protect Mr. Owen from liability. These Germans held shares properly allotted to them, but on which nothing had been paid, although a call of 5s. per share had been made. The petition had been served upon the company in accordance with the rules, and there was no opposition. Mr. Borland, who was appointed managing director on the same day that the agreement was executed, was entitled to a certain amount for salary, and had commenced an action in respect of it and obtained judgment. He, however, now appeared for Mr. Aston Cross and offered no opposition to the petition. The registered offices of the company were at Darlaston, and under the rules where the subscribed capital was under £10,000 winding up should be initiated and carried on at the local County Court. Counsel, however, submitted that as this case was likely to involve intricate questions of law as regards alien enemies, the petition was properly presented in the High Court and should be retained by the High Court.

HIS LORDSHIP made the usual compulsory order, and directed that the winding up should be continued in the High Court.

WAR ITEMS.

Board of Trade Reports.—The following further information has been received at the Commercial Intelligence Branch of the Board of Trade:—

CANADA (New Brunswick).—The Imperial Trade Correspondent at St. Johns reports under date 2nd November that, generally speaking, trade conditions and prospects in the Province of New Brunswick are satisfactory. Wholesale merchants in various lines of business state that there is a good demand for general merchandise, and there is no difficulty in the collection of accounts. Industries have not been seriously affected by the war, and the outlook for farmers is excellent.

ITALY.—According to information received from H.M. Consul at Palermo, it is essential that British manufacturers and merchants desirous of capturing trade in Sicily hitherto in the hands of their German rivals should supply cheap goods, be content with small orders, and study thoroughly the requirements of the market. It is asserted that in many cases United Kingdom firms are unwilling to quote in Italian currency and metric weights and measures, to correspond in Italian, to grant credit, or to send out Italian-speaking travellers.

NICARAGUA.—H.M. Consul at Managua reports (3rd October) that owing to the disturbed financial condition of Nicaragua, British firms would be well advised to defer opening up trade in that country until the financial situation has improved. Although the present period of acute financial depression is not a favourable one for endeavouring to supplant German manufactures on the Nicaraguan market, H.M. Consul states that when commerce revives an effort might be made by United Kingdom manufacturers to obtain a firm footing in the supply of certain classes of goods in which German firms have captured the market with cheaper and more showy, but less durable, articles.

BRAZIL.—H.M. Consul at Sao Paulo reports under date 19th October that the British merchants in that town whom he has approached have not lost sight of the fact that the present state of affairs in Europe should facilitate the introduction of British goods at the expense of German manufactures. They point out, however, that owing to disturbed financial conditions in Brazil it would be unwise at present to undertake an active campaign with this object. Money is scarce, and merchants do not feel disposed to sell goods on long terms of payment. German firms have been successful largely because they have sold a cheap class of article, which is readily bought by the local merchants, and have granted easy terms of payment, 30, 60, 90 and 120 days, and even six months, being allowed.

No Connection. — We have received the following letter:—"Our notice has been called to the title of the Switchgear Construction Company, Limited, a new company which, we understand, has recently been formed to take over the switchgear business of the Union Electric Co., Ltd., and which is now in occupation of works used until recently by Messrs. Voight and Haeffner (England), Limited. As we consider the title in question so closely resembles that of our company as to be likely to cause confusion, we beg to inform you that we are in no way connected with the above mentioned company nor, in fact, with any other company or business concern. We have decided to circularise this letter as the only means of protecting ourselves, since there appears to be no remedy at law enabling us to restrain the company in question from using the word 'Switchgear' as part of its title.

"Our own title, 'Switchgear & Cowans, Limited,' was adopted with the object of retaining the identity of the Switchgear Company, Limited, and Cowans, Limited, when in 1911 we acquired and amalgamated those two old established companies for the purpose of continuing the business of manufacturing electrical switchgear.—Switchgear & Cowans, Ltd. (J. Sermon, Director and Secretary), Manchester. Nov. 28th, 1914."

Iron and Steel Trades.—For the third time since the commencement of the war the price of steel in this country has been advanced, a rise of 5s. per ton having been instituted by the English Steel Makers' Syndicate a few days ago. . . Shipbuilders' requirements have been very heavy of late, and are likely to continue so. Activity in the iron and steel industry appears, indeed, to be assured, at least until next spring, while business is already being booked for dates further ahead. . . . There have been various indications of late of growing confidence in the future among iron and steel producing companies, and the fact that so many of them have recently declared interim dividends on the same scale as at this time last year, while in one case a first interim distribution has been announced for many years, renders it practically certain that for the current twelve months the total return on the capital of most of these companies will not be less than for 1913-14, and may be more. The point upon which iron and steelmasters lay most stress just now is that the recent elimination of German competition may be regarded as likely to remain operative for probably a decade. The only adverse development which seems likely to arise at present is a shortage of labour owing to the requirements of the army for precisely the class of man who is indispensable to mining and smelting operations.—"Financial Times."

German Contracts.—A correspondent of the "Financial Times" (Nov. 26th), writing with reference to the Trading with the Enemy Act (1914) Amendment Bill, says:—"Although attention has been drawn to the necessity of embodying clauses dealing with the question of existing contracts with the enemy, I do not think that it is widely realised that this is a point of immense importance. To my knowledge there are contracts of national importance which may be held up almost indefinitely unless proper covering clauses terminating these continuing contracts with German firms are embodied in the present Bill. To allow contracts to continue to be held up in this way will (failing such remedy) bring about untold inconvenience and confusion and be entirely against public interest. Incidentally, also, if these contracts can be now placed with English companies it will mean, besides bringing money into the pockets of English firms, very considerable employment of labour.—T. W. Cole, Moorgate Court, E.C." We wonder whether these contracts relate to machinery for an electric supply station?

Australian Trade.—In the course of an interview with the "Sunday Times" (Sydney), Mr. T. G. Milne, H.M. British Trade Commissioner in Australia, said:—"At the present moment I am engaged in taking out a whole lot of lines in which Germany has been increasing her trade with Australia in recent years. I will then get samples and details of cost, and bring the English buyer and seller together. The commercial war is going on all the time, but only now are we beginning to realise that it is the duty of patriots to take sides in the commercial war just as well as in the military war.

"I feel I should refer to the increasing American competition with British trade," said Mr. Milne. "When I arrived in Australia eighteen months ago, I ventured to predict that the opening of the Panama Canal would give American manufacturers in the Eastern States much readier access to Australian and New Zealand markets. That prediction is being verified. A vessel is at the present moment loading up in New York with American merchandise for this market. The European war will, of course, give the American manufacturers a great filip, providing they can get the shipping facilities. But our duty is to deal Imperially, and not to build up other nations, whether friendly or not. Remember to provide your country with the silver bullet!"

American and German Trade.—Mr. J. Rogers Flannery is in this country, at 64, Victoria Street, London, S.W., as the Chairman of the Foreign Trade Commission of Pittsburgh, Pa., U.S.A., for the purpose of inviting inquiries regarding materials and supplies hitherto obtained in markets not now accessible on account of the war. The principal materials for which Pittsburgh is known are steel and iron, machinery, electrical supplies of every description, tin-plate, glass, cork, etc.

Red Cross Almanack.—Messrs. Abdullah & Co., Ltd., have issued an almanack for 1915 with monthly sheets bearing reproductions of drawings of Empire and war interest by well-known artists. The proceeds of the sale of the first 20,000 copies at one shilling each are to be devoted to the funds of the British Red Cross Society.

What's in a Name?—"J.E.G." writes calling our attention to an advertisement in the "Times" for Nov. 10th, in which Major Stulpnagel announces that, with the leave of the Authorities, he has changed his name to that of "Swinton," and wonders if the gallant major would have chosen this particular name had he read Mr. Campbell Swinton's views on Teutons, as recently expressed in our columns.

The Eagerness of Burnley Tramwaymen.—The Burnley tramway manager having reported to his committee that 136 employés of the department have joined the forces, and that he has reached the minimum number with which he can work the service properly in the future, it has been decided that if any more employés desire to enlist they shall make application in the first instance to the manager, who will bring the applications before the committee.

Manchester Ball.—Among the contributions acknowledged for the Manchester Relief Fund on Saturday was one of £20 8s. 2d. from the Manchester Electrical Engineers' Ball.

Northampton Tramway Managership.—According to the "Northampton Mercury," there is a strong difference of opinion in the Tramways Committee concerning the filling of the post of manager vacant by the resignation of Mr. J. Gottschalk. A week ago a sub-committee was appointed to go into the whole of the matters pertaining to the management. The sub-committee made careful inquiries; they inspected every branch of the undertaking, and recommended to the full committee that the position should be advertised. This course, however, the full committee declined to adopt. A proposition that Mr. J. C. Cameron, the electrical engineer, be appointed manager for a period of six months was met by an amendment for the appointment of Mr. G. H. Margrave, the chief of the clerical department. There was a majority against Mr. Margrave, and the recommendation for the appointment of Mr. Cameron will therefore go forward to the Town Council.

Belgian Refugees' Free Rides.—The Halifax Tramways and Electricity Committee have decided to grant free passes on the tram cars to the Belgian refugees resident in Halifax until the 31st December next, and, subject to a satisfactory report from the traffic manager, to renew the privilege at the end of that period.

Blackpool Whist Drive.—Something like 2,000 persons attended the annual whist drive and dance held in the Empress Ballroom, Blackpool, on Nov. 25th, under the auspices of the Corporation Electricity and Tramways Employés' Institute. The proceeds were divided between the Belgian and local relief funds and the Employés' Institute.

Personal.—According to news received in Musselburgh, Mr. Fred S. Hayburn, his wife and child, have reached London safely from Brussels. Mr. Hayburn has been an inspector with the Marconi Co. in Brussels for seven years, and was at his post when the Germans occupied the city. It is interesting to note that Mr. Hayburn was shut up in Ladysmith during the siege as a Natal Government telegraphist, and was later a prisoner in the hands of the Boers.

Mr. E. W. Sleight, manager of Carlisle Tramways Co., has joined the Public School Battalion for the Royal Naval Brigade.

The St. Helens Cable & Rubber Co., Ltd., announce that their London representative for cables, ebonite and electrical goods, Lieut. F. E. Phillips, is now (though still in their employ) serving with H.M. Forces. Mr. R. W. Whitley will take over his work in the London district until his return.

Mr. Walter J. Cridge, who has many friends in the Birmingham and Sheffield districts, has joined the Queen's Westminster Rifles.

Our readers will be interested to learn that Mr. Rollo Appleyard, who is so well known in telegraph, engineering and other circles, has been granted a commission as Lieutenant, R.N.R.V., for special service, dating from Nov. 5th. He has been appointed to H.M.S. "President." Mr. Appleyard has long taken a very close interest in naval engineering matters, and his contributions to the Press on such subjects have been of considerable value. He has our congratulations and best wishes on his present appointment. Mr. Appleyard is a Justice of the Peace and a member of the Institution of Civil Engineers.

Roll of Honour.—Sergeant Alex. Evans, who was a conductor on the Potteries Electric Tramways, who went to the front on August 10th, has been killed in action since November 2nd, when he wrote home that he was having a rough time in the trenches.

Private Harry Hickling, of Salford, formerly employed at the Westinghouse Works, has died at Brighton from wounds received in the battle at Lille.

BUSINESS NOTES.

Dissolutions and Liquidations.—The Leitner Electrical Co., Ltd.—Under the failure of this company, which carried on business at Maybury, Woking, and Moscow, a statement of affairs has been lodged in the Court showing unsecured creditors, £25,739; other liabilities, £5,553, of which £5,350 is expected to rank for dividend; preferential creditors, £274; assets expected to produce £11,301, and a deficiency estimated at £42,263 with regard to contributories. The assets consist of cash, £3,960; stock-in-trade, £1,324 (estimated cost, £5,003); office furniture, &c., £91; good book debts, £3,187; and doubtful and bad debts together amounting to £5,470, and estimated to produce £2,739. The deficiency of £42,263 is accounted for as follows:—General expenditure in carrying on business from date of formation of company to date of appointment of provisional liquidator, viz., £21,919; directors' fees from date of formation, £407; losses and depreciation, written off in company's books, £2,398. Losses and depreciation now written off:—Bad debts, £2,631; stock, £4,009; machinery, &c., £11,849; furniture, fixtures, &c.

£488; purchase of licence, patent fees, &c., £5,931; Russian agency, £8,931; patterns and tools, £1,211; goodwill, £1,100; claims for salary, &c., £5,350. Deduct:—Gross profit from date of formation of company, £16,104; royalties, £5,066; commissions, &c., £47; premium on issue of founders' shares, £2,745.

The report of Mr. W. J. Warley sets forth that the winding up order was made on October 13th, 1914, on the petition of a creditor presented July 18th, 1914. The Official Receiver had been already appointed provisional liquidator on July 28th, 1914, for the protection of the assets, and Albert William Wyon, chartered accountant (Messrs. Price, Waterhouse & Co.), a director of the company, was appointed special manager of the business, which has been continued by him to a limited extent under arrangements made with Henry Leitner, the owner of the patents worked by the company. The company was incorporated on September 19th, 1911, with a nominal capital of £27,500, divided into 25,000 preference shares and 2,500 founders' share of £1 each, to acquire from Leitner a licence to work his system of automatic electric lighting for trains and vehicles on a royalty basis. The Leitner system had previously been worked by Accumulator Industries, Ltd., which was unable to continue doing so owing to want of capital. The purchase price of £2,700, payable by the company to Leitner, was satisfied by the issue of 2,500 preference and 200 founders' shares fully paid up. The first directors were Viscount Templetown, Captain J. D. Walker and E. T. Sturdy. Leitner was appointed managing director on September 27th, 1911, at a salary of £600 a year, but subsequently a further agreement was entered into with him under which he received £1,000 a year for seven years from September 30th, 1913, and also a minimum yearly royalty of £1,000. On January 31st, 1912, A. R. Jenkins was appointed a director, but he resigned on May 8th, 1913. Viscount Templetown and Captain Walker resigned on October 2nd, 1913, when W. R. Preston and Major A. A. Armstrong took their seats on the board under an agreement with J. Stone and Co., Ltd. W. R. Preston resigned on June 24th, 1914, A. W. Wyon being appointed in his place. The original working capital was provided chiefly by E. T. Sturdy and his relatives, 7,783 preference and 362 founders' shares being subscribed for up to September, 1913. Other shares were subscribed for by J. Stone & Co., Ltd., under an agreement dated September 23rd, 1913, and in April, 1914, 6,000 preference shares were issued equally to E. T. Sturdy and J. Stone & Co., Ltd., for advances made in connection with the Russian business. At the date of the winding up, the issued and paid-up capital was £22,201, consisting of 20,001 preference and 2,200 founders' shares. The company's business was at first carried on at 7, Princes Street, Westminster, the apparatus for the electric lighting system being made for it by other firms. The users of the system included some of the leading railway and other transit companies. Considerable royalties were received from the Rotax Motor Accessories Co., who were appointed agents for the sale of the Leitner motor car lighting apparatus. Latterly, the business was carried on at Woking. In July, 1912, Leitner visited Russia to arrange for the opening of a branch there, and eventually works were equipped at Moscow, where work was executed for the Russian Government railways. On October 2nd, 1913, Henry A. Lehrs, of Moscow, was appointed commercial director of all the Russian business carried out by the company. A considerable number of lighting sets had already been delivered when the war broke out, and a sum of about £4,000 was payable to the company subject to satisfactory inspection. Having regard, however, to the amount reported to be required to satisfy the liabilities in Russia before this sum could be collected, instructions have been given to close the works. On May 8th, 1913, the company acquired an option to purchase the assets and business of the Accumulator Industries, Ltd., carried on at Maybury, Woking, which it did not exercise, but subsequently the arrangement to purchase the assets and business was embodied in the agreement referred to below. The company, however, worked the business under an agency agreement up to July, 1914. On September 23rd, 1913, a working agreement was entered into with J. Stone & Co., Ltd., who are makers of another system of electric lighting for trains, &c., under which the respective operations and spheres of influence were determined. The agreement provided, *inter alia*, for (1) the subscription for shares and the purchase of part of the interest of the existing shareholders, whereby a sum of £7,001 would be available for the company; (2) the issue of debentures for £14,000 by the company for the purchase of the freehold estate and factory at Woking belonging to Leitner, together with the assets of the Accumulator Industries, Ltd.; (3) the alteration of the articles of association, so that two directors (Preston and Armstrong) should be nominated by J. Stone & Co., Ltd., and two by the company, one of the former to be chairman, with a casting vote. Under the above agreement J. Stone & Co., Ltd., subscribed cash for 3,718 preference shares, and acquired from the other shareholders 3,283 preference shares at par; they thus held, after taking into account 2,500 vendor shares which had been issued, a majority of one preference share and a controlling interest. The proceeds of the sale of their 3,283 preference shares were used by the shareholders in paying for 538 founders' shares at varying premiums, the average being £5 2s. per share; the premium reserve of £2,745 created thereby was used in the business. As consideration for the agreement, J. Stone & Co., Ltd., were allotted 1,100 fully-paid founders' shares, their holding in founders' shares being then equal to the other shareholders. The alteration of the articles of association was duly carried out, and the first meeting of the new directorate, consisting of Preston, Armstrong, Sturdy and Leitner, took place on October 29th, 1913, when the question of erecting an electro-mechanical works at Woking was considered and sanctioned subject to a bank overdraft being obtained, which was afterwards arranged and guaranteed by J. Stone & Co., Ltd., up to an amount of £10,000, in respect of which E. T. Sturdy guaranteed £2,500 to Stone & Co. The erection of the works and the purchase of the necessary plant and machinery was proceeded with at once in the expectation that the freehold property would be duly conveyed to the company in exchange for debentures. The works were completed about April, 1914, when the manufacture of the company's dynamos was commenced there. The company's funds, however, were not sufficient to meet its current expenses, and it was reported to the board (Sturdy and Leitner) on May 28th, 1914, that J. Stone & Co., Ltd., had refused any extension of the overdraft, which then amounted to £10,400. The company's position was considered at a board meeting on July 2nd, 1914, at which a scheme for discharging the liabilities subject to voluntary liquidation was proposed by Leitner, but not agreed to by J. Stone & Co., Ltd., who put forward an alternative proposal, which also was not agreed to. The meeting for voluntary liquidation was held on July 13th, 1914, but the necessary resolution was not passed, nor at a subsequent meeting held on July 24th. Meanwhile, the company's position at the works at Woking had become critical owing to its failure to issue debentures to Leitner under the agreement of September 23rd, 1913. On June 25th, 1914, Leitner's mortgagee of the property, who was to have been satisfied out of the proposed issue of debentures, appointed a Receiver, the company remaining as tenant for a few weeks until it gave up possession on the property being sold. The expenditure on the works of £11,849 is written off in the deficiency account, there being nothing realisable owing to the foreclosure. Leitner has given notice to the company determining the licence on the ground that the whole of the royalties payable to him have not been paid as requested. The licence is not included among the company's assets. The company's trading resulted as follows:—For the year ending September 30th, 1912, net loss, £2,427; for the year ending September 30th, 1913, net profit, £850; for half-year ending March 31st, 1914, net profit, £2,716.

The company had apparently been brought to a profit-earning stage. The sales were increasing, and it is stated that there were more orders in hand than it could carry out. Unsecured creditors, £25,739, include the claim of J. Stone & Co., Ltd., for the bank overdraft of £8,071 paid off by them, and sums of £1,199 and £1,370 due to Leitner on royalty and cash accounts respectively; the remaining claims are chiefly for machinery supplied to the Woking works. "Other liabilities, £5,553," include a claim for £5,000 by Leitner for the unexpired portion of his agreement as managing director, but he has intimated that he has further large claims against the company under various agreements. "Preferential creditors, £275," are chiefly for staff salaries. The cash at bank, £3,948, has been collected. The stock, £1,324, consists partly of loose plant stored at Woking, which it has not been considered advisable to sell in the present circumstances, and partly of stock used by the special manager in carrying on the business. Most of the good book debts have been collected, but the doubtful and bad debts, £5,470, estimated to realise £2,739, include an estimated sum £2,400 from the Russian Government Railways, which is only payable conditionally. The assets and liabilities in Russia are not included in the statement of affairs, and the total expenditure on the Russian account of £8,931 is written off in the deficiency account. The special manager since his appointment has carried out most of the outstanding orders, and the business is now practically closed. It is stated that his trading has resulted in a substantial profit being made. The failure of the company is attributed by the late secretary to lack of co-operation between the directors, which is confirmed by such of the individual directors as have made explanations.

Mordey-Fricker Electricity Meter Co., Ltd.—A Correction.—In the notice of this company appearing in our last issue, we announced a meeting of *creditors* to be held on December 23rd. The *London Gazette* announcement, from which our information was obtained, was for a meeting of *members*, and an inaccuracy occurred in the preparation of our paragraph, which we regret. As a matter of fact, the company has no creditors, having sold its business and patents to the British Insulated and Helsby Cables, Ltd. The company is being wound up voluntarily.

The Llanelly Motor and Electrical Engineering Co., Ltd.—A meeting of creditors is called for December 3rd, at 28, Baldwin Street, Bristol, by the liquidator, Mr. A. Collins.

British Metal Engraving Co., Ltd.—A meeting of creditors is called for December 2nd, at 3, Warwick Court, Gray's Inn, W.C., by the joint liquidators, Messrs. R. F. W. Fincham and W. Reacher.

The Premier Lighting and Engineering Co., Ltd.—A meeting of creditors is called for December 2nd, at Chancery Lane Station Chambers, Holborn, W.C., by the liquidator, Mr. J. P. W. Goodwin.

The Jandus Arc Lamp (Continental Patents) and Electric Co., Ltd.—A meeting of members of the company will be held at 46, Brown Street, Manchester, on December 30th, to hear an account of the winding up from the liquidator, Mr. A. A. Gillies.

The Clifton Electrical Engineering Co., 3, New Street, Birmingham.—Messrs. W. A. Nelson and J. L. South have dissolved partnership by mutual consent.

Green & Smith, electrical and mechanical engineers, Holbeck Lane, Leeds.—Messrs. J. D. Green and W. I. Smith have dissolved partnership. Mr. Green attends to debts. The firm will continue to trade under the same name.

Private Arrangements.—Allan Hartley & R. W. Leek (trading as Hartley & Leek), electrical engineers, 5, Keighley Road, Colne.—A meeting of the creditors in the above matter was

held on November 24th, when a statement of affairs was presented, showing liabilities amounting to £708, and assets estimated to produce £348, from which had to be deducted preferential claims of £19, leaving net assets of £329. It was reported that the business was started on September 1st, 1911, with a capital of £66. The partners attribute their present position to the fact that they have been charging too low prices, and have consequently been working too cheaply. The drawings of the partners have been on an average £1 8s. 8d. per week each. Neither of the partners has any separate estate. No offer was submitted, and it was decided that a letter of authority should be executed in favour of Mr. Hargreaves, accountant, Colne, and, should it be necessary, that the debtor be called upon to execute a deed of assignment. The following are creditors :—

Adams, Beardsall & Co.	£14	Siemens Bros. & Co.	£17
Baxendale & Co.	70	Ward & Goldstone	20
Frankenburgs, Ltd.	90	Baxendale Bros.	28
Falk, Stadelmann & Co.	34	Mudd, James	6
General Electric Co.	25	Whittaker, Wm.	6
Gratrix, Ltd.	156	Grimshaw, J., Ltd.	27
Scattergood & Johnson	14	Hyde, R., & Sons	6
Steel Tubes Co.	26	Watson, Benson	102
Stearn Electric Lamp Co.	28		

A Hard-Worked Motor.—The elasticity of the electric motor in dealing with its work under trying conditions is well illustrated by the record of a motor supplied by the GENERAL ELECTRIC CO., LTD., to a large firm, whose factories the company had electrified. The motor was of 50 H.P., running at 200 R.P.M., and was driving a pair of heavy crushers. The firm's engineers noticed that at times the ammeter needle swung off the scale, and it was decided to ascertain the extent of the peaks, with suitable instruments. The result of the investigation was the discovery that overloads of 160 per cent. were attained. The purchaser reported that under this condition the commutation of the motor was beyond reproach, and, although the average load was above the rating of the motor, it showed no tendency to overheat.

Trade Announcements. — THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., have made arrangements with Messrs. T. J. Grainger & Co, Edinburgh Life Building, 21, Mosley Street, Newcastle-on-Tyne (telephone, Central 3474 ; telegrams, Outshine, Newcastle-on-Tyne), to act as from December 1st as sole agents for their electrical apparatus covering "Vickers" switchgear, D.C. motors, lever switches, motor control panels, controllers, mining switchgear and motors, crane panels, fans, starters, electric lighting accessories, porcelains, heating and cooking apparatus, &c. Messrs. Grainger's area will be Newcastle and District, including Cumberland, Northumberland and Durham (excepting the Tees).

The business of the CLIFTON ELECTRICAL ENGINEERING CO., of 3, New Street, Birmingham, has been taken over by Mr. John Lett South.

Catalogues and Lists.—NATIONAL BOILER AND GENERAL INSURANCE CO., LTD., National Buildings, St. Mary's Parsonage, Manchester.—48-page illustrated catalogue of boiler fittings and other articles for steam-users and engineers. A separate list illustrates the National patent fusible plugs.

MESSRS. JOHN LINE & SONS, LTD., 63, Cornwall Street, Birmingham.—Lists relating to "Duresco" paint for rendering woodcasing fire-resisting, and other specialities for the protection of metal surfaces, &c.

THE BENJAMIN ELECTRIC, LTD., 1A, Rosebery Avenue, London, E.C.—New season's catalogue (L5) of 96 pages, containing illustrated particulars and prices of a wide collection of Benjamin wireless clusters and other lighting specialities, such as reflectors, "Dim-a-lite" attachments, half-watt reflector fittings, electric horns for motor and marine service, tools and accessories.

INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., Silvertown, E.—24-page illustrated list (No. 27) giving tabulated prices of gutta-percha, india-rubber, silk and cotton-covered wires for bell, telephone, winding coil, shot-firing and other service ; also jointing tools, jointers' tents, rubber gloves, &c.

MESSRS. H. BRUNNER & CO., 10, Philpot Lane, London, E.C.—Priced leaflet of new patent pole caps for wooden and steel poles.

Bankruptcy Proceedings.—WM. WALKER, formerly carrying on business as a dealer in electric lamps, at 2 and 3, Red Lion Court, Fleet Street, E.C., under the style of David Smith and Company.—At the London Bankruptcy Court on Tuesday, an application for an order of discharge was made to Mr. Registrar Linklater. Mr. Tindale Davis appeared for the Osram Lamp Works, Ltd. (petitioning creditors), in opposition to the application, and Mr. E. W. Hansell appeared for the bankrupt. Mr. Egerton S. Grey (Official Receiver), reported that the applicant failed last April with ranking liabilities £968, and no assets whatever. He came to this country from Wellington, in 1908, and in July, 1911, he commenced trading as above, with £28 of his own money, and £762 borrowed from a lady, who subsequently became his wife. The business was unsuccessful, and in December, 1912, the Osram Lamp Works, Ltd., obtained an injunction restraining him from selling certain lamps, on the ground that they were an infringement of their patent. In July, 1913, the company obtained judgment against the bankrupt for £176, the costs of the action. In December, 1912, the bankrupt closed the business in Red Lion Court, and in the following February he opened a similar business in Edgware Road, under the style of "The Imperial Engineering Co." He closed this business after two or three weeks, and in April, 1913, opened another at 6 and 7, Charing Cross Chambers, Adelphi, where he traded as "The Preston Engineering Co." The latter business was, in May, 1913, converted into a company, of which the bankrupt acted as managing director, at a salary of £2 15s. a week, which position he held when the Osram Lamp Works, Ltd., instituted these bankruptcy proceedings. The bankrupt attributed his failure to the costs of the litigation with the petitioning creditors, and to loss on the trading.

The only offences alleged by the Official Receiver were (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities ; and (2) imperfect book-keeping. Mr. Hansell asked for the discharge to be granted subject to a judgment for £52. He pointed out that the total liabilities did not exceed £967, and out of that £762 was due to the bankrupt's wife, who would make no claim if the applications were acceded to by his Honour. The amount of £52 would be sufficient to pay £25 to the petitioning creditors for the costs of the petition, and a dividend of 2s. 6d. on the liabilities, apart from that to Mrs. Walker. Mr. Tindall Davis opposed on the ground that the bankrupt's position was due solely and wholly to his having infringed the patent rights of the petitioning creditors. After considerable discussion, his Honour adjourned the hearing for a fortnight to allow the bankrupt's offer to be further considered.

GEO. E. HIPKINS, electrical engineer, 48, Wolverhampton Street, Dudley.—Receiving order made November 24th on debtor's own petition.

W. H. WOOD, electrical engineer, Birmingham.—First meeting, December 9th, at 191, Corporation Street. Public examination, December 16th, at Court House, Birmingham.

TRUBIE MOORE, electrical engineer, Leeds.—First and final payment under scheme of arrangement of 7s. 4½d. in the £, on December 8th, at the Official Receiver's office, 24, Bond Street, Leeds.

W. R. WEDGE, electrical engineer, Northampton. — Trustee, A. Ewen, Official Receiver, The Parade, Northampton, released November 12th.

ALFRED J. LOADER, medical electrician, 15, Carr Road, and late of 3, Forest Street, Nelson, Lancs.—Receiving order made November 26th on debtor's own petition.

Book Notices.—"The Physical Review." Vol. IV, No. 5. November, 1914. Lancaster, Pa. : The American Physical Society.

"Safety Rules to be Observed in the Operation and Maintenance of Electrical Equipment and Lines" ; "The Testing of Potentiometers" ; "The Emissivity of Metals and Oxides" ; "Adjustments of the Thomson Bridge in the Measurement of very Low Resistances" ; "*Bulletin* of the Bureau of Standards." Vol. 10, No. 4. Washington, U.S.A. : Government Publishing Office.

The P. & O. Diary and Almanac for 1915, issued by the P. & O. Steam Navigation Co. of 122, Leadenhall Street, London, E.C., contains particulars of the company's fleet and services, its directors, officials and agents, P. & O. mail tables, and a number of most serviceable maps, the flags of merchant vessels of different countries, and a calendar and daily diary space for 1915. It is a most handy pocket booklet for all business men who are interested in communications between this country and India, China, Egypt, Japan and Australia.

For Sale.—Tenders are invited by December 12th, for the sale of electrical and motor plant and stock of the Electrical Engineering and Motor Co. (Carlisle), Ltd. Particulars appear in our advertisement pages to-day.

The Neath Corporation Electrical Committee has for disposal two 10-KW. air-cooled transformers, 2,200 to 220 volts, 50 py. Particulars are given in our advertisement pages to-day.

Argentine.—A North American firm of electrical manufacturers, which has a capital of $30,000,000, has decided to open a branch in Buenos Ayres to which it will give a capital of $600,000 gold, and has already acquired the necessary premises.

A decree has been published approving the conditions of the call for tenders for electrical materials for the navy during 1915.—*Review of River Plate.*

Catalogues Wanted.—THE AUTOMOBILE AND ELECTRICAL EQUIPMENT CO., of 2, Kingly Street, Regent Street, London, W., invites manufacturers and others to forward catalogues, &c.

Cinema Lighting. — The Tower Cinema Picture House, recently opened at Peckham, which is said to be the largest in London, is fitted throughout with "Pope Elasta" wire lamps, some 2,500 lamps being installed there.

LIGHTING and POWER NOTES.

Argentina.—The Special Committee of the Rosario City Council, which has had the question of electric lighting charges under consideration, has entered into an *ad referendum* contract with the Rosario Electricity Co., which provides for an 18 instead of the 40-year period in the old concession, and for a reduction in price of energy all round.

The nine months' output of the Campania Alemana Transatlantica de Electricidad ended September, amounted to 49½ million units, as compared with 45 million units in the previous year.

The electricity supply at San Justo (Santa Fe) has just been inaugurated.—*Review of the River Plate.*

The following electric lighting concessions have been granted:—By the Government of Cordova, to Pedro Perla, of the Makenna Electric Works, to supply the Commune of Pueblo Torres, and to Messrs. Sigel & Co. to establish an electric station and supply a service of public and private lighting in the Commune of Capella del Monte. By the municipality of Monte Grande (Province of Buenos Ayres) to Zurchi Corti, to erect a station and supply current to Monte Grande. The municipality of Rauch (Buenos Ayres) has received the form of conditions of tender sanctioned by the Ministry of Public Works, and is now in a position to invite tenders for the concession to supply that town with electricity. The public service will need some 70 750-candle (8-ampere) arc lamps.

Australia.—At the present time the Adelaide Municipal Tramway Trust has power to supply electricity to the Government only, but in 1910 leave was obtained to amend the Bill of 1906, by which power would have been given the Trust to sell electricity to the Commonwealth and State Governments and the metropolitan municipal bodies. The amendment was, however, never introduced, but is now being considered by the Electric Light and Gas Services Commission in Adelaide, Mr. W. G. T. Goodman, chief engineer of the Trust, having been called to give evidence.—*Australian Mining Standard.*

The Northern Suburbs E.L. and P.S. Corporation has made an offer to supply the North Sydney Council with electricity, in view of the probable delay on the part of the Sydney City Council in giving a supply.

The shelving of the Greater Melbourne Bill will prevent the extension of the municipal electric lighting enterprise of the Melbourne City Council, which is at present limited to supplying its own residents. Suburban residents are largely supplied by private undertakings such as the Melbourne Electric Supply Co.

Blackpool.—Exhibition.—The second annual Trades Exhibition, arranged by the Blackpool tradesmen, is to open to-morrow (Saturday, December 5th) in the Winter Gardens. An electrical display is to be made by the Corporation, and demonstrations of cooking by electricity will be given.

Proposed Loan.—It is proposed to apply for L.G.B. sanction to the borrowing of £24,000 for electricity works extensions.

Boston.—Prov. Order.—Mr. Robert Arthur Smith, of Palace Chambers, Bridge Street, Westminster, has applied for a prov. order for E.L. at Boston, Skirbeck, Skirbeck Quarter, Fishtoft, Freeston, Wyberton, Frampton and Kirton.

Bridlington.—I.M.E.A. Bill.—The Electricity Committee has received a letter from the I.M.E.A., stating that the Association did not contemplate taking any decisive action with respect to the Joint Bill this session.

Brighouse.—The Electricity Committee of the T.C. has decided that "a discount of 5 per cent. be allowed on such alternating current accounts as are now subject to discount where the consumption is not less than 6,000 units per month, and a further discount of 5 per cent. where the consumption is at least 9,000 units per month."

Burnley.—The new elementary schools in Cuthbert Street and Lionel Street are to be lighted by electricity.

Canada.—According to a financial statement by Sir Adam Beck on the municipalities supplied through the Hydro-Electric Commission, for the first nine months of the year, in every case a surplus is shown.

Canadian electrical plants are credited with producing last year 1,543,464,097 kw.-hours, of which 772,597,049 were exported and 770,867,048 were used at home. The largest producer was the Ontario Power Co., which generated 694,720,900 kw.-hours, and exported 282,123,004; the Canadian Niagara Power Co. produced 411,635,000, and exported 40,021,428; the Electric Development Co. was the third largest producer with 234,039,670, and 42,154,000 exported; the Western Canada Co. produced 62,553,130 kw.-hours, of which 23,213 891 were exported.

It will be seen that Canada exported more electricity than she consumed at home.

The third unit of the plant of the Canadian Western Power Co. will shortly be completed, increasing the plant capacity from 25,000 to 37,000 h.p., and next year four units are expected to be in operation, giving a total of 50,000 h.p.

It is proposed to construct a large hydro-electric plant, to have a capacity of 100,000 h.p., on the Speel River, 35 miles south of Juneau, Alaska.

Continental Note.—Germany.—According to the *Daily Express*, the petroleum famine in Berlin has induced the Berlin Electricity Co. to offer to light the houses of the poorer classes with electricity at less than the cost of oil, without making an installation charge.

Coventry.—Proposed Loan.—The City Council on December 1st decided that application be made to the L.G.B. for sanction to a loan of £55,897 for the purpose of extensions of the buildings and plant of the electric light works. It was explained that they had nearly reached the maximum capacity of the works. It is proposed to install a new 3,000-kw. turbo-alternator and marine type boilers of an evaporative capacity of 30,000 lb. of steam per hour, which is an increase of 10,000 lb. upon the boilers now in use. The manager is authorised to proceed with the preparation of plans, and the work of constructing the foundations will be carried out by direct labour.

Dover.—The War Office has approved the terms of the agreement with the T.C. for the supply of current for power purposes, subject to certain modifications. The Electricity Committee recommends that the charge of 2½d. per unit be adhered to, and the terms of the agreement be extended to all War Department buildings which might be from time to time constructed, acquired, or leased within 60 ft. of the Corporation's distributing mains.

Erith.—Year's Working.—The annual report of the Council's electricity undertaking for the past year shows a gross profit of £10,071, an increase of £1,606 as compared with the previous year; the net profit for the year was £2 531.

The units sold advanced from 2,477,590 to 2,788,825, equal to an increase of 12½ per cent., which has been obtained by an addition of only 3½ per cent. in the working expenses (including the extra cost of coal). Reference is made to the necessity of considering further plant extensions at an early date.

Exeter.—Proposed Loan.—A loan of £1,500 for services has been applied for by the T.C. The Isolation Hospital, at present lighted by oil lamps, is to be wired for electricity.

Fife.—Claims for reduction of valuation were intimated by the Fife Electric Power Co. and the Wemyss and District Tramways Co. at a meeting of Kirkcaldy Parish Council. The first-named company claimed a deduction of 85 per cent. from the gross valuation, which is at present reckoned at 25 per cent. The Tramway Co. claims a deduction of 94 per cent. in place of 33⅓ per cent. as at present.

Greater London Electricity Supply.—The Bromley (Kent) R.D.C. and East Barnet D.C. are urging the postponement of the above scheme until after the war. The Croydon R.D.C. is protesting against the scheme.

The Hornsey B.C. is calling a conference of all the outside local authorities, with a view to joint action in opposing the Bill.

Hornsey.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the Council of £4,000 for house services.

The B.C. has decided to contribute 10 guineas towards the cost of the appeal against the Ilford and Long Eaton cases, provided that a defence fund of £200 is created.

Ilford.—In May last, the Electricity Committee of the U.D.C. accepted the offer of Boiler Air Bridges, Ltd., to fit a boiler at the electricity works on trial with their apparatus, with a view to the reduction of the emission of smoke. The electrical engineer reports that the action of the bridges has been to reduce considerably the emission of smoke, and the test will be continued until the next meeting of the Electricity Committee, when the question of purchasing the apparatus will be considered.

Kirkby Stephen.—Proposed E.L.—The Council is recommended not to oppose the proposed electric lighting scheme of Mr. C. H. Best, of Bradford, subject to a satisfactory agreement being signed, and to all posts erected on the highway being approved by the Council's surveyor.

Knaresborough.—The R.D.C. has unanimously decided to oppose the Harrogate Corporation's proposal to promote in Parliament a Bill authorising an extension of the borough's electric lighting powers in the rural district.

Leek.—Two explosions of street boxes occurred in Broad Street last week, stated to be due to accumulations of gas; a woman was thrown down and rendered unconscious.

Llanidloes.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to a loan for the purchase of the undertaking of the Electric Light Co.

London.—St. Marylebone.—At the last week's meeting of the Council a proposal was put forward to refer back to the Works Committee for further consideration, &c., a balance of the street lighting account, in view of the fact that only about 43 per cent. of the lamps are at present in use. Councillor D. Watson, chairman, E.L. Committee, pointed out that his committee's contract was for the adequate lighting of the borough at a certain fixed sum per annum. It was very favourable to the Council; for the last three or four years some 120,000 c.p. more than was contracted for had been given, and despite this extra supply, the contract price this year was being reduced by £400 per annum. Ultimately the motion was withdrawn.

The L.C.C. Finance Committee has recommended the Council to sanction the borrowing by the Islington B.C. of £1,263 for mains, £3,029 for transformers, £458 for house services, and £225 for meters, in connection with the Council's electricity undertaking.

Maidstone.—The T.C. has disposed of two 100-kw. sets at the electricity works to the Marconi Co. for Government use, for £700 each. A recommendation to contribute up to £50 towards the cost of the I.M.E.A. Bill for giving increased powers to local authorities, has been rejected by 11 votes to 10. The L.G.B. has sanctioned a loan of £1,350 for extensions to the boiler house and offices at the electricity works.

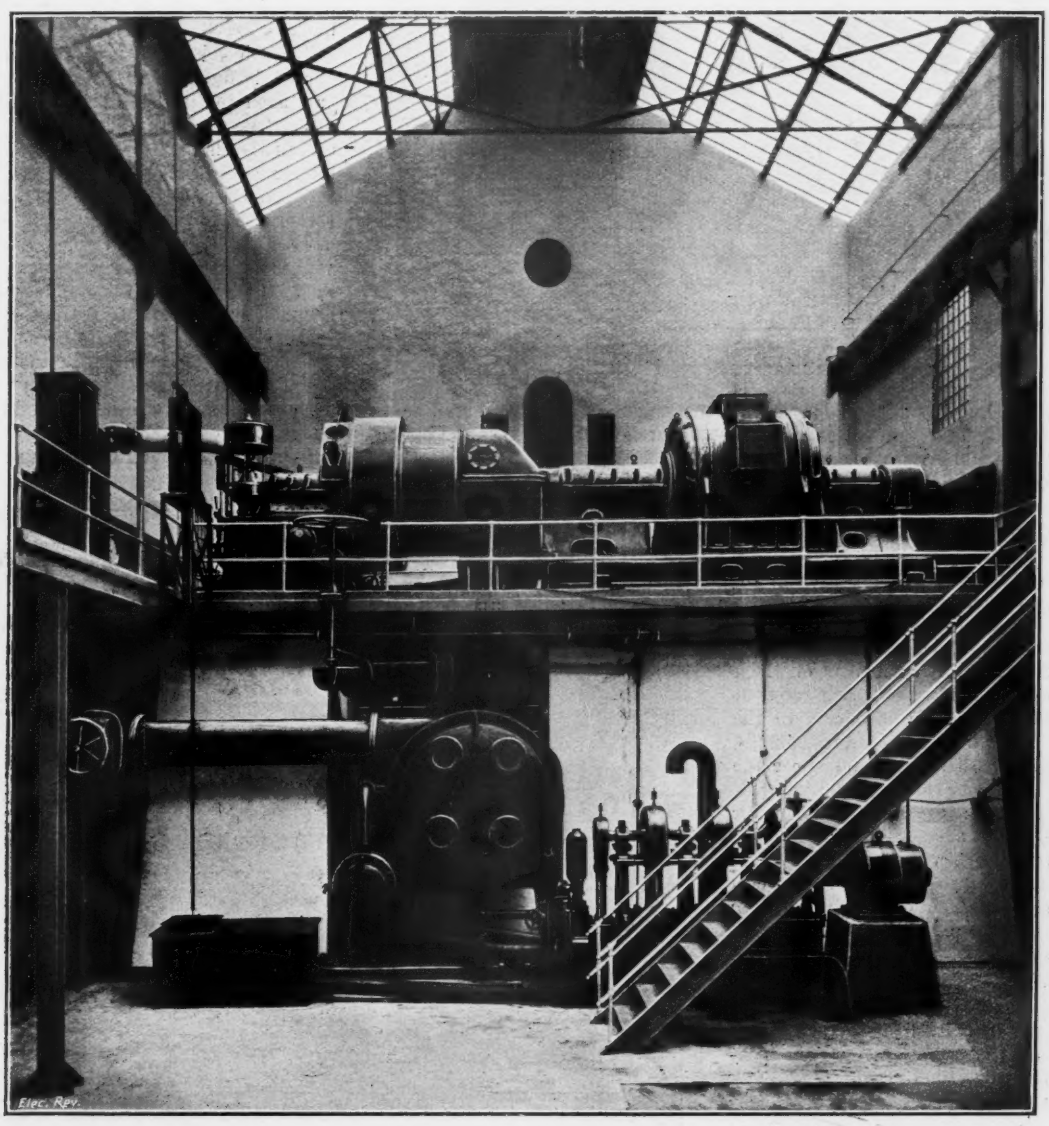
(*Continued on page 759.*)

HACKNEY ELECTRICITY WORKS EXTENSION.

On Saturday last the new extensions of the municipal electricity works were the subject of an informal inspection by the chairman (Councillor T. A. Blane) and members of the Electricity Committee, under the guidance of the Borough Electrical Engineer, Mr. L. L. Robinson, M.Inst.C.E. It is just over 13 years since the undertaking was formally opened, and 10 years since we published a full description of the installation* ; even at that early date the station, which was designed by Mr. Robt. Hammond, had earned a reputation for economy in working, the total works costs at 1·03d. per unit being claimed to be the lowest in London. The plant was characterised especially by the use of steam-driven balancers and a large battery, both of which items have abundantly demonstrated their value in maintaining continuity of service under all conditions ; there has, in fact, never been a single interruption of the supply since the commencement.

The growth of the load—largely accelerated by the institution of a showroom some years ago—was met at first by additions to the direct-current plant and mains, the principal generating sets being two 1,500-kw. Westinghouse and Dick, Kerr dynamos driven by triple-expansion vertical Belliss engines, which have done excellent work and are still in first-class condition. In 1911, however, foreseeing a greatly increased demand, Mr. Robinson drew up a comprehensive scheme to meet the requirements of the future, with generation and transmission by three-phase current at 6,000 volts, 50 cycles, and distribution from sub-stations feeding the existing d.c. network, except in the case of very large consumers, who would be supplied directly from the extra-high-pressure mains.

On the advice of Messrs. Preece, Cardew & Snell, the Borough Council adopted the scheme, which provided for the installation of three 3,000-kw. generators ; but it has been found necessary to prepare for still larger demands, and while one 3,000-kw. machine has been installed, the second set, which is now on order, is of 5,000 kw. The new engine-room and boiler-house are built on to the older buildings, with the boiler-house between the engine-room and the River Lea, this arrangement permitting of the most convenient and direct handling of coal. The buildings are of steel frame construction, with concrete panelling, and cost about £25,000 ; they were erected to the general design of Mr. Robinson, under the supervision of the Council's architects, Messrs. Gordon & Gunton.



Willans-G.E.C. 3,000-kw. Turbo-Alternator and Condensing Plant.

* Elec. Review, March 11th and 18th, 1904.

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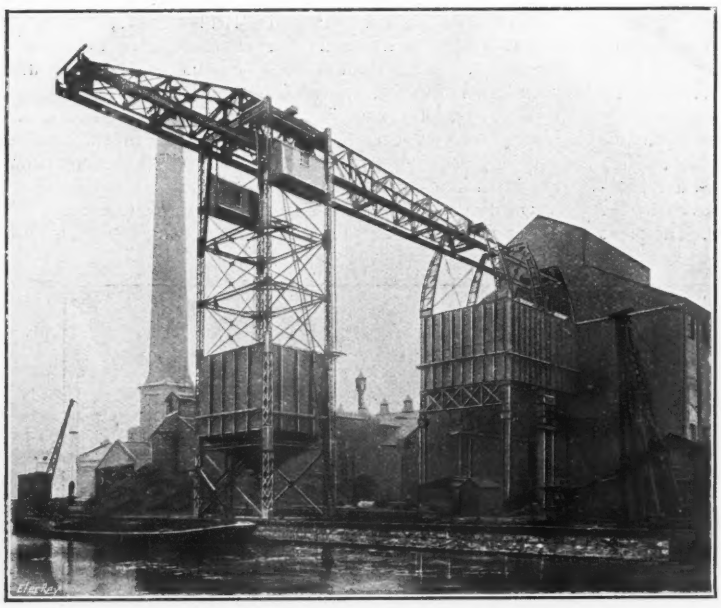
In addition to the 3,000-KW. set now installed, the engine-room provides accommodation for two 5,000-KW. sets, and a 1,500-KW. Peebles-La Cour motor-converter, which is already in position, and links together the D.C. and A.C. systems. A lean-to building alongside of the engine-room houses the air filters and cables in the basement; lavatory, messroom and E.H.T. switchgear on the ground floor; and the offices for the works superintendent and the engineer in charge, as well as the control switchboard, on the first floor, the switchroom affording a clear view of the engine-room, through a glazed partition.



Coal and Ash-Handling Telpher Railway.

The present boiler-house represents half of the complete scheme, affording accommodation for four boilers, of which two have been installed, each rated at 33,000 lb. of steam per hour. In the basement are the steam pipes, feed pumps, hot-well and ash railway, and above the boilers are the economisers and induced-draught plant; one Green economiser of 520 pipes, and one ejector type steel chimney have been erected. The coaling plant runs in the roof over the coal bunkers. The end of the boiler-house is at present closed with galvanised iron.

A small building near the river accommodates the circulating water pumps.

The whole of the buildings are fireproof, and hydrants fixed to the bunkers provide against the danger of spontaneous combustion of coal.

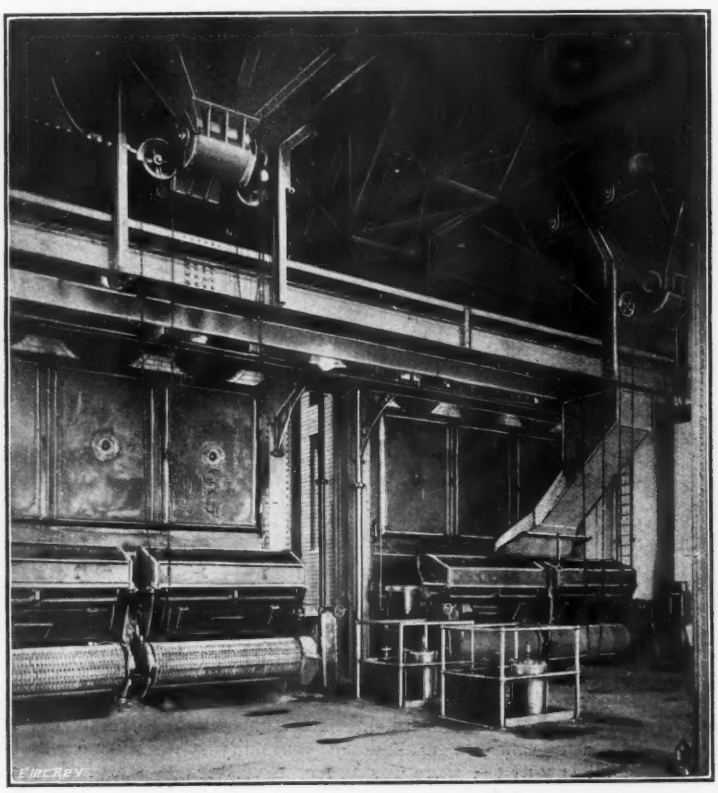
The coal-handling plant is of the telpher type, built by Messrs. W. J. Jenkins & Co., at a cost of £8,918; it is capable of handling 40 tons per hour, when both telphers are in operation. The telpher track extends the length of the boiler-house and beyond to the river, where it is supported by a steel girder and tower, the latter containing the ash bunker and the Avery weighing machines, which register the quantity of coal delivered by the contractors. The coal is raised by a grab from barges, and is deposited in the bunkers wherever desired; the grab lifts 50 cb. ft., at 80 ft. per minute, and the telpher travels at 450 ft. per minute. The motors were made by the British Thomson-Houston Co., Ltd.

The bunkers have a total capacity of 1,300 tons; their sloping sides are lined with granolithic concrete spread on expanded metal, and lead to double outlet valves, of which one set is at present in use. As the coal leaves the bunker it falls into a travelling shoot, being weighed again in the process; the shoot serves both boilers, and can feed any of the four mechanical stokers from any of the four bunker outlet valves. When the other two boilers are erected, a second travelling shoot will be installed, utilising the other set of bunker outlet valves. The shoot runs on ball bearings, and can be traversed by hand with ease; it has the advantage that if a run of inferior coal occurs in one hopper when a heavy load is on, a supply of coal can be obtained from any other part of the bunkers.

The ashes that pass over the dumping bars fall into hoppers, from which they are taken by tipping trucks running on a narrow-gauge railway to a pit, and eventually they are dealt with by the telpher grabs. The riddlings fall into ash-pans beneath the grates, and are put through the fire again.

Feed water is derived from an Artesian well, and is exceptionally soft; it is pumped by two compound pumps, supplied by Messrs. J. P. Hall & Co., Ltd., either of which can feed three boilers at normal full load; the steam cylinders are lubricated only with graphite, so that the exhaust steam can be passed directly into the hot-well through injectors.

The boilers, induced-draught plant and Green economiser were supplied by Messrs. Babcock & Wilcox, Ltd. The boilers are of the land type, with double chain-grate stokers and superheaters, and each is capable of supplying 33,000 lb. of steam per hour at 200 lb. per sq. in., superheated to 600° F. The valves and fittings are Hopkinson's. The

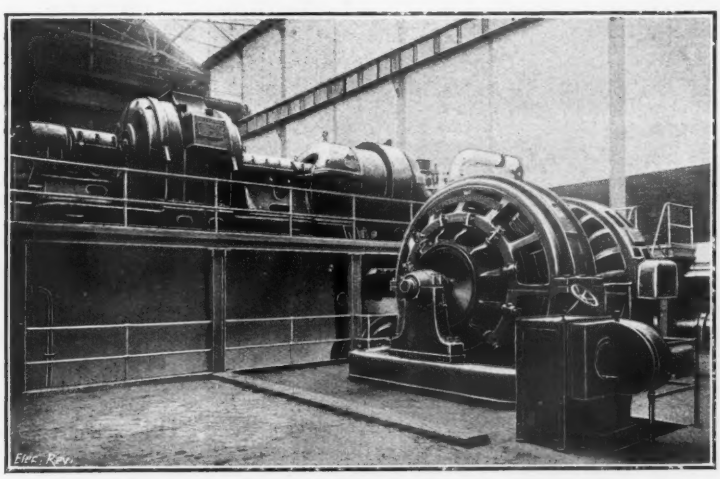


B. & W. Boilers and Travelling Shoot.

induced-draught fan was made by Messrs. Davidson & Co., and is driven by a Westinghouse motor, with a Brook, Hirst starter-controller, giving speeds from 490 to 700 R.P.M. The steel chimney was made by Messrs. Danks. The plant gives a draught of not less than 1 in. water gauge at the boiler dampers under any conditions of load.

A cast-iron conduit, with hoppers on the economiser floor and boiler floor, enables flue dust to be dropped directly to the ash railway in the basement.

The steam-piping is of lap-welded steel, and is carried through the boiler-house basement, a separator with a Sentinel trap being provided at each branch, which drains to the hot-well. The latter is at a lower level than the hot-well in the old works, and a difficulty was met with in running the two works together off any of the boilers and still maintaining a proper supply of water to both hot-wells. This was overcome by putting a ball-valve on the overflow from the turbine air-pump discharge pipe into the new hot-well, and taking a branch to discharge under water in the old hot-well. Both hot-wells are provided with make-up ball-valves supplied from a storage tank, which come into operation in case of emergency. The scheme has been completely successful, both hot-wells filling to a proper working level automatically, no matter how the load on the boilers and generators is changed about.



TURBO-ALTERNATOR AND MOTOR-CONVERTER.

Circulating water is derived from the river, by way of two 36-in. intakes, with filter screens. At present there is a single 36-in. main to the engine-room, and a similar discharge; duplicates can be provided later. The circulating pump was supplied by the Rees Roturbo Co.; it has a vertical shaft, and is driven by a Laurence-Scott motor of 42 H.P., the pump being in the basement of the pump house below water level, and the motor on the ground floor. The plant delivers 3,600 gallons per minute against a head of 30 ft. at 700 R.P.M.

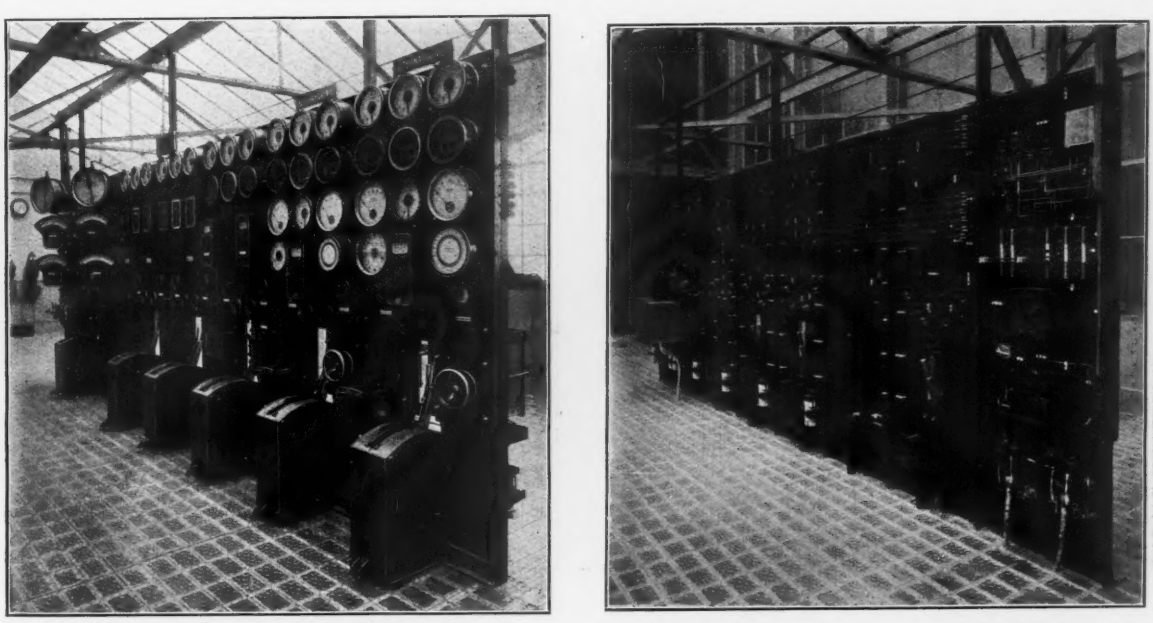
The engine-room is served by a 25-ton three-motor travelling crane supplied by the Chatteris Engineering Co., Ltd., and the pump house by a two-ton hand-operated crane by Messrs. Herbert Morris, Ltd.

The contractors for the turbo-alternator, condenser and air pump were Messrs. Willans & Robinson, Ltd.; the plant has an output of 3,000 KW., with a power factor of 0·85, at a speed of 1,500 R.P.M. The turbine is of the disk and drum type, and has a guaranteed steam consumption of 15·25 lb. per KW.-hour at half-load, 13·95 lb. at full-load, and 15·25 lb. at 1¼-load, including all accessories, but it is expected to give results 0·5 lb. better on test. The condenser is also of Messrs. Willans and Robinson's make, and is provided with a vacuum augmentor condenser.

The air pump, by the same makers, is of the Edwards type, driven by a British Thomson-Houston motor of 17 H.P. at 154 R.P.M., with a Brook, Hirst starter. It is connected with a force pump, which discharges the condensate from a Lea Recorder to the hot-well.

The alternator and exciter were supplied by the General Electric Co., Ltd. The generator is cooled with air drawn through a Balcke cloth filter, but wet air filters will be installed for the later machines. The field of the exciter is separately excited from the D.C. supply, and the pressure is controlled by hand or by a Taylor-Scotson regulator.

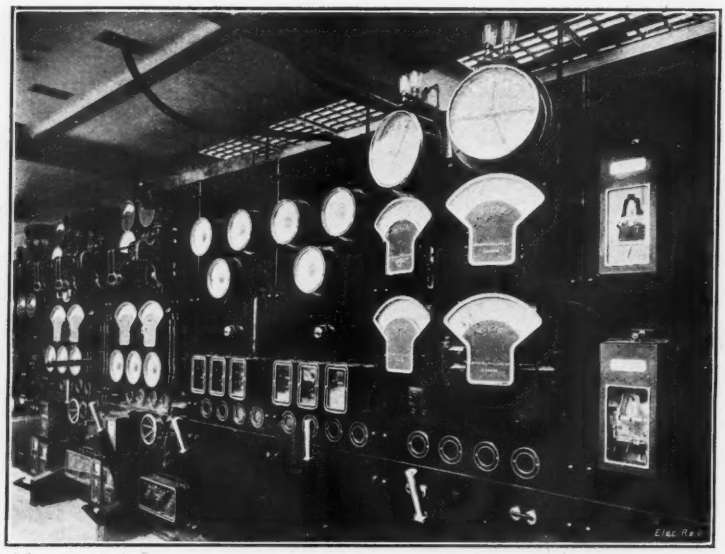
Messrs. Ferranti, Ltd., were the contractors for the switchgear, which, as at present installed, provides for one 3,000-KW. and one 5,000-KW. turbo-alternators, one 1,500-KW. motor-converter, and two 0·15-in. three-core feeders. The switchgear is situated in a locked room on the ground floor, and is of very substantial construction; the oil switches are mechanically operated from the control board on the first floor, which is illustrated herewith. The bus-bars are in duplicate, and provision is made for running



FERRANTI CONTROL SWITCHBOARD, FRONT AND BACK.

in conjunction with a supply from an external source, either in parallel or on separate districts. Merz-Price protection gear is provided for the feeders, and reverse power trips for the machines.

The excitation of the alternator exciters can be derived from either side of the battery, and an automatic change-over switch is fitted on the board, which cuts out the Taylor-Scotson regulator in the event of an accident to the booster, leaving the machines on hand regulation. The wiring of the control board is extremely simple and accessible, as shown by our view of the back of the board; pilot lamps show the position of each generator-switch, and to which set of bus-bars it is connected. Ammeters are provided in each phase, as well as power factor, power and energy meters for each machine, and the usual synchronising gear, &c.



Johnson & Phillips Switchboard at Dalston Lane Sub-Station.

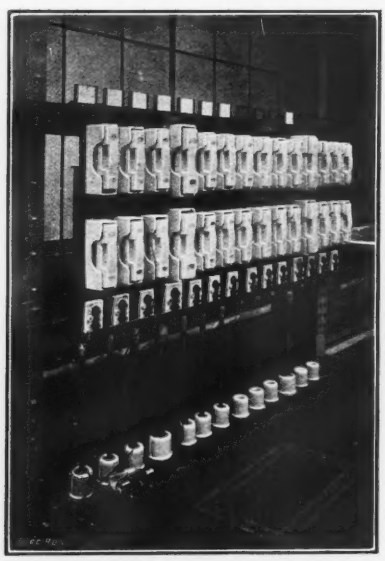
The Peebles-La Cour motor-converter in the power station is rated at 1,500 KW., 500-575 volts D.C., at 273 R.P.M., and has an efficiency of 92·25 per cent. at full load, 91·75 at three-quarter load, and 90·5 at half-load, when converting from A.C. to D.C. It is capable of carrying a much heavier load on occasion, and needs no adjustment at any load.

The E.H.T. feeders are laid out as ring mains, feeding three sub-stations; the old works will eventually become a fourth sub-station. The total length of conduit line is about 10,000 yards; six ducts are provided round the northern half of the ring, and nine round the south, and when these are filled, the capacity of the system can be doubled by laying mains across the middle of the ring. The ducts are of fibre, supplied by the Key Engineering Co., Ltd., 4 in. in diameter, and were laid in concrete by Messrs. Foote & Milne, Ltd., the total cost being £15,500.

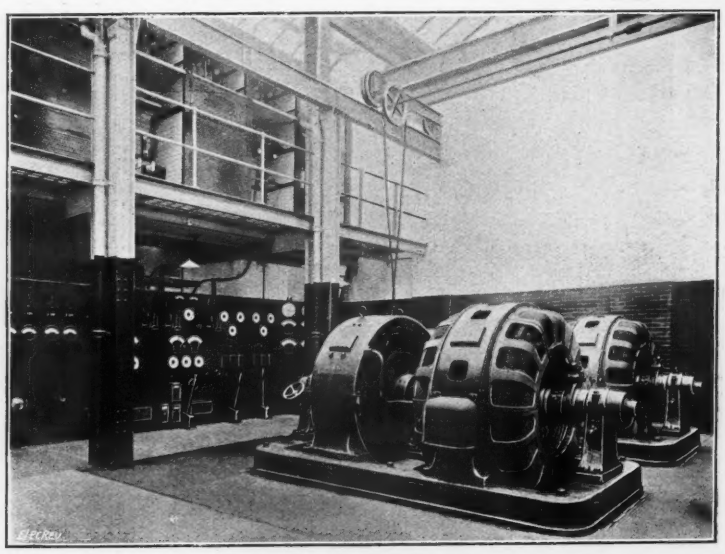
The feeder ring at present installed consists of one 0·15-in. three-core, paper-insulated, copper-shielded, lead-covered cable, made by the British Insulated & Helsby Cables, Ltd.; it is suitable for 11,000 volts working pressure, and was laid by the works staff. A three-core pilot cable, paper-insulated and lead-covered, for use in connection with the Merz-Price protection gear, and a six-pair signal cable, have also been drawn in.

Each of the sub-stations has at present a capacity of 1,000 KW., the plant consisting of six 500-KW. La Cour converters, having a full-load efficiency of 91·5 per cent. The switchgear was supplied by Messrs. Johnson & Phillips, Ltd., and is of their standard construction, the extra-high-pressure cells being on a gallery and the control and low-pressure feeder board on the ground floor, as shown in the view below. The oil switches are operated by levers and rods. Spark-gaps and Brazil earthing resistances are installed to deal with surges. The switchgear and measuring apparatus is, in general, similar to that at the power station, with duplicate bus-bars. The isolating switches are provided with triggers to prevent them from opening in the event of a short circuit. The D.C. change-over switches are fitted with double knife blades, so that a machine can be changed over without interrupting the circuit. At the right-hand end of the board is a panel for recording the pressure at a large number of feeding points.

A 10-ton hand-operated travelling crane by Messrs. Herbert Morris, Ltd., is provided in each sub-station.



Power Station Distribution Board.

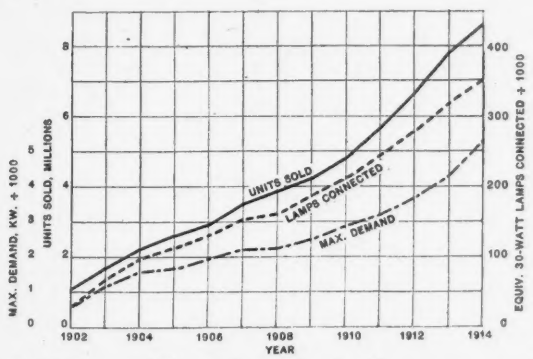


Dalston Lane Sub-Station.

The low-pressure feeders, consisting of concentric and triple-concentric cables, paper-insulated and lead-covered, were supplied by the British Insulated and Helsby Cables, Ltd., and laid by the works staff, either armoured and direct in the ground, or on the solid system in earthenware troughs. The old feeders from the power station are being cut and looped in to the sub-stations, and by this means their carrying capacity will be increased nearly six-fold.

The total cost of the scheme, so far as it can be at present ascertained, amounts to £124,262, of which £63,926 was expended on the power station buildings and plant, and £60,336 on the transmission and distributing system. A 5,000-KW. turbo-alternator and condensing plant, by the same makers as the present set, will shortly be installed, at a cost of £15,750.

Much delay has been incurred in carrying out the scheme, mainly due to contracting difficulties, the lock-out in the building trades, the war, and the necessity of diverting one of the L.C.C. main sewers. The final result, however, reflects credit on all concerned, and the new system will ensure an adequate and economical supply of electrical energy to the borough, which has a population of nearly a quarter of a million.



In 1904 we published charts showing the progress made by the undertaking in the two previous years; we now give a diagram showing its growth during the whole period of its existence. The load has been largely lighting, and the load factor has remained fairly steady between 18 and 21 per cent. for many years; but power, heating and cooking have made remarkable progress of late, and a cold morning means a difference of 500 to 1,000 KW. to the demand, showing plainly that the number of radiators installed must be considerable. The Council also hires out B. & K. cookers, at 5s. or 7s. 6d. a quarter; these are going off well, and we have seen a letter from a very satisfied consumer who is enthusiastic in the praise of his electric cooker. Motors aggregating 6,842 H.P. are connected to the mains. The prices charged for lighting are 6d. and 1d. on the maximum demand system, or 3½d. per unit on the flat rate; for power £1 per quarter per KW. of max. demand, and ½d. per unit, or a flat rate of 1½d. per unit. A domestic rate of £2 per KW. per quarter in advance, and 1d. per unit, is also offered.

The Council undertakes electrical contracts and maintains a sales department, upon which a profit is shown. The cost of production for the last complete year was 0·70d. per unit, and the cost including loan charges, &c., was 1·34d.; the average price obtained was 1·55d., and a net surplus of £6,644 was recorded.

Our thanks are due to the Borough Electrical Engineer, Mr. L. L. Robinson, for facilities to photograph the works and for assistance in the preparation of this article; to which we add our congratulations upon the continued success of the undertaking under his control.

LIGHTING and POWER NOTES.

(*Concluded from page 754.*)

Manchester.—LOAN APPLICATION.—The City Council is recommended to make application to the L.G.B. for sanction to borrow £543,000 for the establishment of an electricity generating station at Barton. The approximate cost of the scheme £1,775,000, is put forward by the Electricity Committee with reservation, as it is impossible, it says, to forecast electrical engineering developments for any length of time. It is, however, the scheme of which the present application forms a part.

Mayo.—ASYLUM LIGHTING SCHEME.—The Mayo County Council has been informed that the Board of Public Works was not prepared to recommend the granting of a loan at the present time for installing electric light at Castlebar District Asylum, as the matter was not sufficiently urgent. It was resolved to postpone the scheme until after the war.

Newport (Mon.).—LOAN SANCTION.—The L.G.B. has sanctioned the application of the Corporation to borrow £16,150 for mains, services and plant, without deduction. No public inquiry was held.

Oldham.—L.G.B. INQUIRY.—An inquiry was held on November 26th into the application of the Corporation to borrow £40,000 for turbo-generators, boilers, cooling towers, &c., at the Greenhill electricity station. The additional plant includes two 3,000-KW. turbo-alternators to supplement the existing 2,000-KW. A.C. supply, and is to meet the growing factory demand, some 12 contracts for A.C. supply, totalling 4,395 KW., having been entered into. There was considerable opposition to the proposal to add further cooling towers on the part of local property owners.

Perth.—PROPOSED DESTRUCTOR.—The question of the introduction of a refuse destructor is being considered by the Corporation. A report to the T.C. states that assuming that it is most economical to work the destructor along with the electricity station, the cost of a modern installation should not exceed from £6,500 to £7,000. It is estimated that the total value of the destructor to the electricity department might be put at £1,055.

Salford.—NEW PLANT STARTED.—The new 5,000-KW. turbo-generator, supplied by the British Westinghouse Co., was formally started last week. The set was manufactured and installed in 19 weeks, and it is proposed to add a similar unit later.

The Electricity Committee has entered into agreements with the Industrial Chemical Syndicate, the Bradford Dyers' Association, Ltd., and the Prestwich U.D.C. for the supply of energy.

Selby.—PROV. ORDER.—The U.D.C. has decided to oppose the application of the Yorkshire Power Co. for a prov. order to supply electricity in the district, and to apply for an order itself.

Southampton.—PROV. ORDER.—The Corporation has decided to apply for a prov. order to supply electricity within the parish of Bitterne.

The Electricity Committee has had under consideration the recommendations contained in the experts' report upon the Council's electricity undertaking, and has decided (1) to build up and maintain a reserve fund of £15,000, and to transfer the unappropriated balance at the end of March 31st, 1914, viz., £5,137, to depreciation and renewals fund; (2) to reduce by one-eighth of a 1d. per unit the charge for tramway current for power purposes, commencing with the next financial year.

Stanley.—PROV. ORDER.—The Electrical Distribution of Yorkshire, Ltd., intends to apply to the B. of T. for a prov. order to supply electricity for lighting purposes within the urban district.

Stoke-on-Trent.—L.G.B. INQUIRY.—Mr. H. Ross Hooper conducted an inquiry on Wednesday, last week, into an application by the Borough Council to borrow £44,000 for electricity purposes, including £8,000 for supplying Fenton, £2,800 for supplying three-phase current from the new station to Goldendale, £14,056 in connection with the new central power house scheme. About £19,920 of the total represented over-expenditure, chiefly upon the central power house scheme. The remainder is made up of provision for future expenditure on mains and services and extensions, which will ensure every district of the borough having a supply of electrical energy. Goldendale is a manufacturing district in the northern part of the borough, from which applications have been received for motive power purposes.

At the inquiry it was arranged that the central power house should be the generating station for the county borough, and that the four old stations should be regarded and used as sub-stations for the supply of their respective districts.

As from April 1st last there will be only one set of accounts for the undertaking.

Tunbridge Wells.—PLANT EXTENSIONS.—The T.C. has decided on the recommendation of the Electricity Committee to install a battery of two water-tube boilers complete with mechanical stokers, economisers, superheaters and induced draught plant, also a reservoir and cooling tower. Application is to be made to the L.G.B. for sanction to a loan to carry out the foregoing work as recommended by Mr. R. N. Torpy, the electrical engineer.

The T.C. has adopted the recommendation for additional heating at the Sanatorium, and this is to be carried out by the "Hestia" type of electric radiators, amounting in all to 24 KW.

Uxbridge.—SEWAGE PUMPING.—The U.D.C. has under consideration the question of installing additional electric motors to drive the pumps at the sewage works.

Warrington.—COTTAGE LIGHTING.—The cottage homes of the Salford B. of G. at Culcheth are to have an electric lighting installation.

Whitehaven.—The B. of G. has referred to the Finance Committee for consideration and report the question of having the E.L. installed at the Union offices, which are at present supplied with gas.

Wimbledon.—The Electricity Committee recommends the Council to approve of the erection of a transformer station in Coombe Lane, at a cost of £195, also that the I.M.E.A. be informed that the Council is not prepared to incur the expense of complying with the provisions of the Borough Funds Acts in order to join in the promotion of the Association's Joint Private Bill.

The Council has informed the Epsom R.D.C. that it intends to apply to the B. of T. for permission to supply electricity to premises in Great Avenue, Cleveland Road, Royal Avenue, Grafton Road, and Church Road, Worcester Park, and asking for the Council's consent to the supply being given. The electrical engineer reports that the cost of extending the mains from Malden to the roads mentioned, and of connecting 50 premises, would be £1,040.

TRAMWAY and RAILWAY NOTES.

Argentina.—A decree has been granted authorising the Empresa del Ferrocarril Oeste de Buenos Aires to proceed with the electrification of its services between the port of Buenos Ayres and the station Once de Septiembre, and between that station and Moreno.

The Anglo-Argentine Tramways Co. has deposited the plans with the municipality for the projected section of underground tramway between the Retiro station and the Plaza Constitucion, in Buenos Ayres. Construction is to be begun at several points at the same time, and the line is expected to be completed within a year from its commencement.

Australia.—Adelaide Tramway Trust Accounts.—The total operating expenditure for the year ended July 31st, 1914, amounted to £202,503; the net revenue accounts show that the excess of income over expenditure was £125,365, which, with interests and discounts, made a total of £126,306 carried forward for appropriation. The total revenue was £328,809, and the percentage of total operating expenses to total revenue was 61·5 per cent., as against 66·8 per cent. in the previous year. Interest paid to the Government absorbed some £60,000; third-party reserve, £3,467; reserve for renewals, £19,136; and sinking fund, £45,158. During the year over 43¾ million passengers were carried, and 5,325,660 car-miles were run. The total operating cost per car-mile was 9·12d., and the total revenue per car-mile 14·8d. The total route mileage in use was 51·8. Some 12½ million units were generated at the power station, and 9,838,000 were used for traction and car lighting. The maximum ½-hour load on the station was 3,600 kw., and the coal consumed per unit generated was 3·26 lb.

The annual report of the Freemantle municipal tramways for the year ended August 31st shows a credit balance of £14,000, and a net profit, after paying interest, &c., of £8,000.

Barnsley.—Tramway Accident.—Owing to a car running away on a steep gradient, and subsequently leaving the track and colliding with a building, seven people were injured on Wednesday evening.

Canada.—The Ottawa Electric Railway Co. has been compelled to put up an auxiliary steam plant to augment its power owing to the unprecedented low water in the Ottawa River.

Chile.—Anti-German Riots.—Due to an increase in the tramway fares at Valparaiso by the German-owned tramway company, serious disturbances have occurred, the cars and various buildings being stoned by the populace.

Continental.—Portugal.—A decree has been issued by the "Ministério do Fomento," approving a contract entered into between the Portuguese Government and the Companhia dos Caminhos de Ferro Portuguese for the electrification and working of the existing steam railway between Lisbon and Cascais. The concession is for a maximum period of 50 years.

Croydon.—The T.C. has decided to have plans and estimates prepared for the reconstruction of the tramways in the diverted portion of Cherry Orchard Road.

Devonport.—Tramway Accident.—On Friday, last week, a tramcar which had left the Dockyard and was proceeding down a steep incline, got out of control, jumped the rails and overturned. One man was killed and 20 injured, and one of the latter has since died.

Erith.—Year's Working.—The annual report of the Council's tramway undertaking for the past year shows a gross profit of £4,644, an increase of £488. After paying all interest on loans, sinking fund and other charges, there was a deficit of £1,672, an improvement on the previous year of £470.

Edinburgh.—The Corporation has decided to give up the service of motor-'buses on certain routes. Various 'buses were taken by the Government, and the chassis of the remaining three have now been sold to the Scottish Motor Traction Co. The 'buses were petrol-electric driven and cost £807 each: the service was only inaugurated this year, and during the three months the 'buses were running the loss was £785 on working expenses. Edinburgh is served by cable cars and one short electric car line, and the motor-'buses were purchased this year to traverse routes off the cable line.

Halifax.—The revenue of the Corporation tramways from April 1st to the present week shows an increase over the takings during the like period of last year. The revenue to date has been £76,586, as against £73,800, an increase of £2,785.

Manchester.—B. of T. sanction has been received to the proposed laying of a double line of tramway in lieu of the existing lines in Queen's Road, Lamb Lane, Hulme Hall Lane, Pottery Lane, Gorton Lane, Belle Vue Street, North Road, and Stanley Grove.

Newcastle-on-Tyne.—Six Months' Working.—At the annual meeting of the Corporation Tramways Committee on November 26th, Alderman J. H. Rodgers gave a *résumé* of the working of the tramways for the past six months. He said the gross receipts from traffic had been £136,858, an increase of £13,852; they had carried 31,043,032 passengers during the past six months, an increase of 3,044,133 over the corresponding period of last year; and the total receipts were £142,066, an increase of £14,132. The total expenditure was £80,179, an increase of £6,912. The gross surplus was £61,887, and smaller items brought this to £63,540, which was appropriated as follows:—Interest for the half-year, £17,550; redemption of loans, £21,320; income-tax, £2,755; turbine installation, £2,500; and other items bringing up the total to £46,018, against £40,000. Thus there was a surplus on the half-year of £17,522, compared with £16,820. During the half-year they had contributed to the rate £9,000, against £6,000 in the corresponding half-year, and there was left a net surplus of £8,522. The present surplus would bring the reserve up to £100,000 again; but they were still spending out of that fund, and by the end of the financial year in March, it was expected that something like £20,000 or £30,000 would again have been spent out of that fund. It would take all the profits of the next half-year to make up the reserve fund to its level of £100,000.

TELEGRAPH and TELEPHONE NOTES.

Baltic Cables.—The direct Anglo-Russian telegraph service has been interrupted, the cables between Fredericia (Denmark) and Libau, and Fredericia and Petrograd, respectively, having been damaged, probably between Bornholm and Russia. It is considered that they have been cut by German warships. All telegrams between Russia and England and France are now sent *viâ* Stockholm.—*Morning Post.*

Cutting Telegraph Wires.—John Watts, a labourer, was on Saturday sentenced to 18 months' imprisonment, with hard labour, for cutting and destroying telegraph wires on the Great Central Railway which connected signal-boxes on the line at South Harrow.—*Standard.*

France.—The French Government has authorised the installation of telegraphic communications in French Equatorial Africa, at a total cost of 760,000 fr.—*Board of Trade Journal.*

German Communications.—A memorandum issued by the German Colonial Office on the course of events in the German Colonies, contains references to the complete interruption of communication by cable and by wireless telegraphy. The wireless stations at Yap, Naru, Tasigata (Samoa), and Bitapaka (New Pomerania), were destroyed by the British, and the big station at Kamina in Togoland was destroyed by the Germans, in August and September. Communication with the Cameroon ceased on August 25th. Most of the information, being derived from sources external to Germany, is familiar to British readers.

New Telegram Rule.—In future the sender of an inland telegram will be required to furnish his name and address before the telegram can be accepted for transmission. This requirement will be regarded as sufficiently fulfilled if the registered telegraphic address of the sender is to be telegraphed as part of the message.

Post Office Telegraphs.—The report of the Postmaster-General, issued this week, states that in 1913-14 87,089,000 telegrams were transmitted, showing a decrease of 1,405,000; the revenue was £2,820,817, a decrease of £47,935, ascribed to the diminished use of the telegraph for short-distance messages, in competition with the telephone. Radio-telegrams numbered 57,252, as compared with 51,109 in the previous year. New licences for wireless stations numbered 1,111, covering 1,195 stations; 90 licences were cancelled or lapsed. The total number of licences in existence on March 31st was 1,963, compared with 942 in the previous year. At the same date the Post Office telephone system comprised 774,821 stations, of which 47,165 were private lines. The number of effective calls during the year was 834 millions, an increase of about 5 per cent. The report will be reviewed more fully in a later issue.

Secret Wireless Stations.—A correspondent of the *Daily Mail* states that, some weeks after the outbreak of war, three men who posed as mining engineers arrived at Ensenada, Lower California, with an electrical machine which was alleged to be intended for locating underground gold deposits. They set up their plant at Alamo, in Mexico, 62 miles from the coast and at an altitude of over 4,000 ft., and secured possession of neighbouring telephone and telegraph lines. But the British Vice-Consul at Ensenada made inquiries and discovered that the electrical plant was a powerful wireless installation with two 130-ft. masts, and a 40-H.P. generating plant, and he communicated with the Mexican authorities, who arrested all the parties concerned and assumed possession of the station. The three engineers, who are awaiting trial, are reported to have been landed by the *Nürnberg* in September at San Francisco.

The German steamer *Preussen*, whilst lying in a Dutch Colonial port, was found to have a secret wireless installation on board, the antenna being concealed in the rigging. The ship was seized and the commander put under arrest.

A private German wireless station at Callao has been discovered, and the Allied Governments have protested to the Peruvian Government.

The Uruguayan Government has issued a decree prohibiting the installation and working of wireless telegraphs on shore as well as on vessels flying the Uruguayan flag unless permission has been obtained from the Government.—*Review of the River Plate.*

Submarine Signalling Apparatus.—In the Prize Court, on Monday, when the case of the *Schlesien* was considered, the Submarine Signal Co., an American firm, claimed that their signalling apparatus was only leased to the owners of the vessel, and, being neutral property, should not be condemned. The Court, however, found that the apparatus, not being merchandise, did not come under the Declaration of Paris; it was part of the ship, and the matter must be dealt with by the Executive.

Turkey.—The offices of the Eastern Telegraph Co. at Constantinople have been seized by the Porte and the staff dismissed. The English manager was arrested, but was liberated a few hours later.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—Corporation Electricity Department. Materials, including cast-iron work, wrought-iron, tubes and fittings, for one year. Mr. J. A. Bell, City Electrical Engineer.

Atherton.—The D.C. is to obtain revised tenders for a 500-KW. set of transformers in substitution for the 400-KW. set previously asked for.

Australia.—BRISBANE.—January 6th, 1915. Copper wire and accessories, paper-insulated lead-covered cable, for P.M.G. See "Official Notices" November 27th.

SYDNEY.—February 15th, 1915. Potentiometer, for the Municipal Council. Specifications (10s. 6d.) from the City Electrical Engineer, Town Hall.—*A. Mining Standard.*

Bacup.—T.C. One 100-KW. and one 50-KW. transformer. Manager, electricity works.

Colchester.—December 10th. Electrical sundries for three months, for Severalls Asylum. Mr. R. Overend, Clerk, the Asylum.

Dundalk.—December 7th. Steel towers for carrying cables, for G. N. Railway Co. (Ireland). Specifications, &c. (£1 1s.), from Engineer's Offices at Dublin or Belfast.

December 8th. Wiring for electric light installations in the artisans' dwellings at St. Brigid's Terrace, St. Patrick's Terrace and Cuchullain Terrace, for the U.D.C. Forms of tender from the Clerk's office, Town Hall.

December 21st. G.N. Railway (Ireland). Electric motors and accessories, sub-station switchboard, hard-drawn copper wire, bitumen wires. See "Official Notices" to-day.

Glasgow.—December 12th. The Corporation invites offers for the installation of electric lighting, telephones, bells and fire-alarms, required at Robroyston Hospital. Mr. W. W. Lackie, Electrical Engineer, 75, Waterloo Street.

Grimsby.—December 12th. 11,000 tons of fine slack coal, for the Electricity Department. Mr. W. A. Vignoles, Borough Electrical Engineer.

Hornsey.—December 29th. E.H.T. switchgear and E.H.T. three-core cable, for the Borough Electricity Works. See "Official Notices" to-day.

Johannesburg.—January 5th, 1915. Materials, renewals, &c., for tramway equipments, for Municipal Council.

London.—L.C.C. December 8th. (*a*) H.T. and L.T. switchgear, (*b*) gravity bucket ash conveyor, in connection with the tramways. See "Official Notices" November 13th.

December 9th. Installation, 160 wiring points, 210 lights, at Star Lane Elementary School, Fulham. See "Official Notices" November 27th.

H.M. OFFICE OF WORKS.—December 7th. Twelve months' supply of cable and wire. See "Official Notices" November 27th.

PORT OF LONDON AUTHORITY.—December 8th. Twelve months' supply of arc lamp carbons. Forms of tender from the Stores Superintendent, 106, Fenchurch Street, E.C.

Manchester.—December 16th. Corporation. Ten 50,000-lb. water-tube boilers complete; two 15,000-KW. turbo-alternators complete. See "Official Notices" November 13th.

December 21st. Corporation. Three reactance coils, for generating station. See "Official Notices" to-day.

Preston.—December 21st. Tenders are invited by the T.C. for the erection of new tramway offices, extension of car sheds, &c., in Deepdale Road. Forms of tender, &c. (£2 2s., returnable), from the office of the Borough Surveyor, Town Hall.

Spain.—Tenders have recently been invited by the municipal authorities of Oliva for the concession for the electric lighting of the town during a period of 10 years; by the municipal authorities of Campillo de Albobuey (province of Cuenca) for a period of 10 years; by the authorities of the town of Aldea del Rey (province of Segovia) for a period of four years: and by the authorities of the town of Olivares de Duero (province of Valladolid) for a period of six years.

December 13th. Tenders are being invited by the municipal authorities of Lillo (province of Toledo) for the concession for the electric lighting of the town during a period of 12 years.

Teddington.—December 7th. Electric lighting at the Council's sewage disposal and refuse destructor works. See "Official Notices" November 27th.

Walsall.—December 8th. Corporation. Six 250-KW. and one 500-KW. rotary-converter equipments. See "Official Notices" November 20th.

Walthamstow.—December 23rd. U.D.C. 1,500-KW. turbo-alternator, 600-KW. triple-expansion engine and dynamo, 1,000-KW. rotary or motor-converter. See "Official Notices" to-day.

West Ham.—December 10th. B. of G. Three months' supply of electrical fittings. Forms of tender from Mr. J. Smith, Clerk, Union Road, Leytonstone, N.E.

Winchester.—December 17th. Corporation. One 500-KW. D.C. turbo-generator, with condensing plant, pipework, &c. See "Official Notices" November 27th.

CLOSED.

Aberystwyth.—The T.C. has accepted the tender of the Chiswick Electricity Supply Corporation, Ltd., for electric light fittings for the Town Hall, at £21.

Atherton.—The D.C. has accepted the quotation of Messrs. Callender's Cable and Construction Co., Ltd., for 360 yards of twin concentric cable; also that of Messrs. G. Hanchett, Barrett and Co., of Pendleton, for one 250-K.V.A. transformer.

Australia.—The following tenders have been accepted:—

Public Service Department, Commonwealth.—
3 miles of switchboard cable, item 1, £229; 3 miles ditto, item 2, £408; 7 miles ditto, item 3, £1,645.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, N.S.W.—
22,000 standard battery cells, No. 1, £1,298; 1,500 ditto, No. 2, £151; 7,500 ditto, No. 3, £1,339.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, Victoria.—
18,318 standard battery cells, No. 1, £1,081; 200 ditto, No. 2, £20; 2,935 ditto, No. 3, £519.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, Queensland.—
200 standard battery cells, No. 2, £20; 400 ditto, No. 3, £71.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, South Australia.—
2,000 standard battery cells, No. 1, £118; 400 ditto, No. 2, £40; 200 ditto, No. 3, £35.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, West Australia.—
3,500 standard battery cells, No. 1, £215; 1,000 ditto, No. 2, £111; 700 ditto, No. 3, £130.—Siemens Bros. Dynamo Works, Ltd.

P.M.G.'s Department, Tasmania.—
400 standard battery cells, No. 1, £24; 100 ditto, No. 2, £11.—Siemens Bros. Dynamo Works, Ltd.

Home Affairs Department.—
Electric goods, lift, postal stores, Melbourne, £970.—Edmiston & O'Neill.

West Australian Tender Board.—
Insulated wire.—J. R. W. Gardam. —*Tenders.*

Blackpool.—The following tenders have been accepted by the Corporation:—

1,500-KW. turbo-alternator.—British Thomson-Houston Co.
25,000-lb. surface condensing plant.—Cole, Marchant & Morley.
24 c.i. switch fuse pillars.—Sykes & Sugden.
H.T. cable and copper trolley wire.—B.I. and Helsby Cables, Ltd.
L.T. cable.—W. T. Glover & Co.

Bolton.—The Electricity Committee has accepted the tender of the Rees Roturbo Co. for boiler feed pumps for Back-o'-th'-Bank works.

Coventry.—The City Council is recommended to accept the following tenders:—

Turbo-alternator.—British Thomson-Houston Co., Ltd., £10,810.
Four marine-type boilers.—Babcock & Wilcox, Ltd., £11,166.
Double stokers.—Bennis & Co., £2,220.
Four economisers.—Green & Son, £3,524.
Bunkers, boiler-house framework, and coal and ash-handling plant.—Bennis & Co., £11,016.
Induced-draught plant.—Babcock & Wilcox, Ltd., £3,595.
Pipework.—Stewarts & Lloyds, Ltd., £2,486.
Cast-iron tank.—Matterson & Co., Ltd., £960.
Cooling towers.—Worthington Pump Co., Ltd., £3,260.

Finchley.—The tender of Messrs. Blackmore & Co. has been accepted by the U.D.C. to supply 500 tons of Warwickshire peas coal to the electricity works, at 13s. 11d. per ton.

France.—The Electrical Engineering and Equipment Co., Ltd., are executing contracts for several thousand miles of telephone cable for the French Government.

Hebden Bridge.—The U.D.C. Electricity Committee has accepted the tender of the Tudor Accumulator Co. for 10 years' maintenance of the storage battery at the electricity works.

Hornsey.—The B.C. has accepted the tenders of Messrs. Bruce Peebles & Co., Ltd., at £2,170, for two motor-converter sets. Nine firms sent in tenders.

Ilford.—The U.D.C. has accepted the tender of Messrs. O. P. Driver & Son, Ltd., of Kettering, for a refuse destructor, at £7,918.

London.—The Metropolitan Asylums Board has accepted the tender of Messrs. Toy & Winslow, at £31, for the provision of electric light at the North-Western Ambulance Station; also that of Messrs. J. W. Gray & Son, at £98, for the installation of a system of internal telephones at South Wharf.

Messrs. Duncan Watson & Co. have secured, against keen competition, the Post Office contract for vacuum cleaners.

Messrs. Johnson & Phillips, Ltd., have received an order from H.M. Office of Works for the supply and erection of new power cables for technical purposes at the Imperial Institute, together with necessary switchgear.

Manchester.—The Tramways Committee has accepted the tender of Messrs. Williams, Harvey & Co. for block tin, and that of Messrs. Smith & Forrest for pitch.

The Electricity Committee has accepted tenders of the B.I. and Helsby Cables, Ltd., and the Macintosh Cable Co., Ltd., for cable.

Shipley.—The U.D.C. has accepted the following tenders for coal at the electricity works :—

Fyfe, Kemp & Co. ..	1,500 tons	A. Kendall & Sons ..	1,000 tons
J. Wade..	1,500 „	Fletchers, Ltd. ..	1,000 „

Pollard & Co., 1,000 tons.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—**Friday,** December 4th, at 8 p.m., at Storey's Gate, S.W.; Tuesday, December 8th, at 8 p.m., at Portico Library, Mosley Street, Manchester; and Thursday, December 10th, at 7.45 p.m., at the University, Edmund Street, Birmingham. Thomas Hawksley Lecture on "Pumping and other Machinery for Waterworks and Drainage," prepared by the late Mr. W. B. Bryan, and read by his son, Mr. B. W. Bryan.

Junior Institution of Engineers.—Friday, December 4th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "A Reversible Turbine," by Mr. S. E. Hutson.

Greenock Electrical Society.—Saturday, December 5th. Visit to Coplawhill Car Works and sub-station of the Glasgow Tramways.

Thursday, December 10th. At 7.45 p.m. At Masonic Rooms, 21, West Stewart Street. Paper on "The Electrical Equipment of a Liner," by Mr. J. E. Allan.

Salford Technical and Engineering Association.—Saturday, December 5th. Annual meeting.

Royal Institution of Great Britain.—Monday, December 7th. At 5 p.m. At Albemarle Street, W. General meeting.

Society of Engineers.—Monday, December 7th. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Ordinary meeting.

Association of Engineers-in-Charge.—Wednesday, December 9th. At 8 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Electricity in the Printing Office," by Mr. F. Broadbent.

Institution of Electrical Engineers.—Thursday, December 10th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Automatic Protective Switchgear for Alternating-Current Systems," by Mr. E. B. Wedmore.

(**Scottish Local Section**).—Tuesday, December 8th. At 207, Bath Street, Glasgow. Paper on "The Magnetisation of Iron at High Flux Density with Alternating Currents," by Mr. J. S. Nicholson.

Electro-Harmonic Society.—Friday, December 11th. At 8 p.m. At Holborn Restaurant. Smoking concert.

Northampton Polytechnic Institute.—Friday, December 11th. At 8 p.m. At St. John Street, Clerkenwell, E.C. Annual prize distribution by the Right Hon. Lord Moulton of Bank, F.R.S.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 12th. At 2 p.m. At Newcastle-on-Tyne. General meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Saturday, December 12th. At 7.15 p.m. At Newcastle-on-Tyne. Paper on "Stability," by Mr. P. Y. Brimblecombe.

NOTES.

The "Electrical Review" during War Time.—As announced in our issue of last week, we shall be pleased to send the ELECTRICAL REVIEW gratuitously to any of our readers who may be serving with the naval or military forces and would like to keep themselves in touch with doings in the electrical world. This offer particularly relates to readers who have left these shores since the beginning of the war, either for active service in the fighting line in France and Belgium or in the Fleet, or for service in Egypt, India or other foreign parts. As the men concerned may not have an opportunity of seeing this notice, we shall be greatly obliged if their friends or acquaintances who know their whereabouts will let them know of our offer, and ask them to communicate their names and addresses to the Manager, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. The matter will then have immediate attention.

Fatalities.—WOLVERHAMPTON.—The inquiry into the cause of death of Thomas Henry Simcox, a tramcar-driver, was resumed on Saturday. The proceedings at the previous sitting were reported in our last issue.

Arthur Millward Pitchford, tramcar conductor, was re-called. In reply to Mr. A. Turton, who represented the relatives of the deceased, witness said the usual method of dragging a car on to the line with a drawbar from another car could not be adopted in this case because both ends of the derailed car were too far off the metals. In witness's opinion the current was going through the deceased until it was switched off, but he had no proof of this.

Bertram Painter, conductor, said his car encountered car No. 5 (Simcox's), which was at right angles to the track. Witness's car went on to the loop, and on Simcox's instructions the two cars were connected by means of a cable. One end was fixed to the front of witness's car and the other end to the rear of Simcox's. The deceased told witness to hold one end of another cable to the buffer, Pitchford being instructed to hold the other end on to the rail to complete the circuit. Simcox moved the car five or six feet. Witness then took the cable from the buffer and threw it towards Pitchford. At this moment one of the front wheels came into contact with the rail, thus earthing the current in the normal way. Shortly afterwards he saw Simcox crouch down, and heard a curious gasping sound. Witness added that he thought Simcox had had a shock.

Joseph Dixon, motorman, agreed with the evidence of Pitchford and Painter.

Mr. W. A. Luntley, general manager of the Corporation tramways, said the car was in proper order, and from tests made upon it he did not think Simcox could have had an electric shock. The working voltage of the tramways was 500 volts. The incident under consideration had no reference whatever to the Lorain surface contact system, the wiring being the same in all types of electric cars.

Mr. Lee, consulting electrical engineer, of Messrs. Henry Lee and Co., Birmingham, was called by Mr. F. Haynes Duffel, who represented the insurance company affected. Mr. Lee said he had a thorough knowledge of the Lorain system. He had examined the car, and had come to the conclusion that Simcox could not have been killed by shock unless he touched a live part of the car at the time when the car was not properly earthed. The current would only have passed through the man if his body had been the easiest path for the current. The fact that the lamps were alight at the time he collapsed proved that the car was efficiently earthed.

Dr. A. M. Bankier, who had attended deceased from October 30th to November 11th for influenza and an ulcerated leg, said that when he examined Simcox there was no sign of any disease tending to shorten life or to give rise to sudden death. This was confirmed by the post-mortem examination, all the organs being found free from disease. Witness agreed with the evidence given by Dr. Black, of the hospital, as to the results of the post-mortem examination. The conditions were consistent with death from electric shock as described in books. Witness could not account for death in any other way.

Dr. W. F. Chalmley, hon. surgeon of the Wolverhampton General Hospital, deposed that he had made an examination of the body. The disease of the heart was sufficient of itself to cause sudden death. The condition of the blood was also met with in other cases of sudden death. Witness found sufficient to cause death from heart disease. Questioned by Mr. Turton, witness said that he could not understand anybody saying that the heart was not diseased.

The Coroner having summed up, the jury retired to consider their verdict, and on their return intimated that they considered death to be due to an accidental electric shock. They placed, they stated, no reflection whatever on the state of efficiency of the tramcar.

Appointments Vacant.—Improver for electricity works (15s.), for borough of Rawtenstall; charge engineer (50s.), two junior engineers (30s.), and four switchboard attendants (25s.), for Bolton electricity department; chief assistant electrical engineer (£250), for Croydon Corporation; four resident engineers (£3 10s., £3, £2 15s., £2 10s. respectively), station superintendent (£3), two shift engineers (£2), six switchboard attendants (31s.), three fitter-drivers (35s.), four assistant drivers (30s.), for an electric generating station in the South of England; engineer-on-watch (£13 per month), for Lancashire Electric Power Co.; junior shift engineer (25s.), for Sevenoaks and District Electricity Co.; assistant electrical engineer (temporary), for Fareham U.D.C. (40s.); engine-driver, mechanical and electrical (34s.), for Parish Infirmary, Camberwell; switchboard attendant (27s.), for Dewsbury Corporation. Particulars are given in our advertisement pages.

The Electro-Harmonic Society.—The next Smoking Concert of this Society will be held at the Holborn Restaurant (King's Hall), on Friday evening, December 11th, commencing at 8 o'clock. Mr. W. J. Tennant will preside. The preliminary programme is as follows :—Mr. Holden Heywood (tenor); Mr. Herbert Heyner (baritone); Mr. W. H. Squire (violoncello); Mr. Will Edwards, Mr. Ben Osborne (humorists); Professor Anders (magician); Mr. Selwyn Driver (entertainer at the piano). Solo pianoforte and accompanist : Mr. Bernard Flanders, A.R.A.M.

Cheap Electric Trucks.—The Ward Motor Vehicle Co. has built new manufacturing shops at Mount Vernon, N.Y., where it will build a low-priced 750-lb. electric truck selling at $875, with a mileage of 35-45 on one charge. The new plant will turn out 3,000 cars a year; these will be equipped with Westinghouse motor, Timken axles, shaft drive, &c., and have a speed of 10-12 miles an hour. One of these trucks was exhibited at the New York Electrical Show, and some 500 are to be built this season.

Inquiries.—Makers of fibre or composition tubes, 2 mm. in diameter outside, for covering connecting wires in telephone instruments, are inquired for.

A reader asks for references to hotels, &c., which are equipped with electric cooking apparatus on a fairly large scale.

The Electric Vehicle Committee.—The Committee having considered the standard charging plug and receptacle has decided that it would simplify matters if, at the present time, the plugs were made for one size of cable only, viz., one having conductors of 0·1 sq. in. section, the earth wire remaining of the section already recommended.

The Committee also had before it some suggestions made by panel "E" of the Engineering Standards Sub-Committee on Electrical Plant and, as a result, it was decided further to revise the specification, which is now being reprinted.

E.V.C. STANDARD SIGN FOR ELECTRIC VEHICLE GARAGES, &c.

Further arrangements were made with regard to the forthcoming Quarterly Journal, and Mr. A. H. Seabrook was appointed hon. editor. He will take over this duty after the issue of the first number, the preparation of which the hon. secretary had undertaken.

We illustrate herewith the Committee's standard sign for charging stations or garages where charging facilities are provided. It may be made either as an enamelled iron sign or as an illuminated sign, with a dark red background, and dark red letters on a horizontal white stripe across the centre of the wheel, the rest of the lettering and the wheel being white.

For a garage the words on the stripe would be "charging garage." The size suggested is 2 ft. 6 in. square.

Institution and Lecture Notes.—Association of Supervising Electricians.—A large number of members and visitors dined at the London Tavern, Fenchurch Street, last Saturday evening, under the chairmanship of their President, Mr. A. H. Dykes, who, in the course of a speech, outlined the ideals of the Association, the work it had already accomplished, and all that still lay before it. He said that the evening's entertainment was not solely a convivial gathering; it was part of their scheme for bringing fresh recruits into their ranks, making better known to one another those who in the ordinary routine of life were in the keenest competition, and creating a smoother relationship as between manufacturer and contractor. Mr. Dykes paid a glowing tribute to the work of the British electricians in France, whose searchlight, telephone, and telegraph service had been, and would be in increasing measure, of incalculable aid to His Majesty's Forces. Officers confirmed this every day. He made special reference to one of the principal objects of the Association—their fostering of the apprenticeship system. After this war there would be a vast amount of work in the electrical trades, work which in the past had been done by those who were now their enemies, and any man who taught a boy these trades, rather than allow him only to run errands, was doing good work for his country.

In response to the President's appeal, the sum of £4 17s. was subscribed by those present for the Belgian refugees.

After dinner the company were entertained by some clever artistes, under the direction of Mr. T. Clayton, one of the members, who himself contributed the recruiting song, "Fall In."

The hon. secretary, Mr. Banister, announced that they had a total of 72 members, and invited gentlemen in the manufacturing and contractors' trades to endeavour to get others to join whom they knew to be eligible.

Institution of Electrical Engineers.—At the meeting of the MANCHESTER LOCAL SECTION on Tuesday last Mr. W. M. Selvey's paper on "Power Plant Testing" was read and discussed.

At the meeting of the YORKSHIRE LOCAL SECTION on Wednesday the same paper was read, and the discussion was adjourned.

Midland Institute.—At a meeting of the Midland Institute of Mining, Civil and Mechanical Engineers at Sheffield on Friday last, Mr. H. R. Webster read a paper on "A Fire-damp Indicator." He said that the electric lamp had come to stay, but as it could not detect the presence of gas, he had devised an instrument for that purpose based on the principle of osmosis. The working of the instrument was explained and demonstrated. Mr. W. Maurice read a paper on "The Case for the Electric Lamp," and emphasised the importance of the proper management of electric lamp-rooms. The President, Mr. W. Hargreaves, stated that since the introduction of the electric light at Messrs. Briggs's collieries, men who had been receiving compensation for nystagmus had returned to work, and Dr. Court said that, in his opinion, the improved lighting would in time do away with the disease.

Junior Institution of Engineers.—Mr. C. E. Ford last Friday read a paper on the subject of "A Model Drawing-Office System." The manufacture of small and complicated apparatus, he said, such as was met with in electrical instrument making, lent itself admirably to systematic subdivision, which was required in order to avoid waste of time and material. The system, as laid out, aimed at obtaining all that was necessary:—(*a*) For manufacturing; (*b*) To avoid overlapping, and to bring about uniformity and interchangeability of manufacture; (*c*) For order and sales execution. For the working of the system four kinds of drawings were necessary:—(1) Stock sheet; (2) Assembling; (3) Part drawing; (4) Partial assembling drawing. After explaining the system, the author mentioned that although he only dealt with it as applicable to electrical apparatus, it could be applied with equal efficiency to any branch of engineering where a large amount of repetition work was in operation.

The first meeting for the new session of the SHEFFIELD AND DISTRICT SECTION was held on Friday last, when Mr. E. B. Christmas gave an address on "Electric Furnaces."

Italian Trade.—An agent in Italy wishes to represent British makers of electric lamps and apparatus. Address inquiries to the British Consulate, Milan.

Fire.—A fire on Tuesday burnt out a two-storey building, used for the storage of electrical goods and patterns, forming part of the large works of Messrs. R. Johnson & Nephew, Ltd., wire drawers and manufacturers, Manchester. The Fire Brigade prevented the spread of the flames to other buildings.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Heston and Isleworth Electricity Committee has decided to increase the salary of MR. M. J. O'BRIEN, mains foreman, to £162 10s., rising to £200 per annum. In future, Mr. O'Brien's designation will be "mains engineer."

MR. L. E. COMLEY has resigned the post of publicity engineer to the Torquay electricity department, in order to accept a post with Messrs. Belling & Co., electric heating and cooking specialists, London.

The Maidstone T.C. has decided to pay MR. E. E. HOADLEY, borough electrical engineer, £100 for extra services rendered during the year ended March 31st, 1908.

The Erith U.D.C. has accepted the resignation of MR. COVENEY, electrical engineer and tramway manager, and has placed on record its appreciation of his 9½ years' services.

Mr. F. WOODS, of the Lancashire Electric Power Co., Radcliffe, has been appointed to the post of station superintendent at the Rawtenstall Electricity Works. There were 77 applicants, five of whom were interviewed.

General.—The Salford Council is to be recommended this week to appoint MR. ERNEST B. MARTIN, M.I.C.E., of Rotherham, to the post of borough engineer in succession to the late Mr. Joseph Corbett. Mr. Martin is at present borough and water engineer of Rotherham, and also tramways permanent-way engineer.

MR. W. R. BROWN, A.M.I.E.E., is resigning his appointment with the A.E.G. Electric Co., Ltd., London, from December 12th.

The Mayor of Blackburn (ALDERMAN THOMPSON) has been appointed chairman of the Blackburn Electricity Committee, with COUNCILLOR HIGHAM as vice-chairman.

COUNCILLOR T. WILKINSON has been re-elected chairman of the Lancaster Electric Tramways Committee.

MR. A. B. M'DONALD, city engineer, and MR. J. FLEMING, treasurer of the gas and electricity department, of Glasgow, are retiring, the former on a pension of £500, and the latter on one of £340 per annum.

For the current municipal year, ALDERMAN DUDLEY STUART, M.I.E.E., has been again elected chairman of the Electricity Committee of Wimbledon Corporation.

COUNCILLOR JAMES HEALD, electrical engineer, has been re-elected chairman of the Electricity Committee of the Lancaster Town Council.

On Tuesday, BAILIE ROBERT KIRKLAND, the convener of the Glasgow T.C. tramways, was made a recipient of a presentation on behalf of the members of the Corporation, on the occasion of his approaching marriage. The presentation, which took the form of a solid silver tea and coffee service and a silver salver, was made by Lord Provost Dunlop.

MR. R. MORITZ, a barrister-at-law, has been re-elected chairman of the Hornsey Borough Council's Electricity Supply Committee.

For the appointment of resident engineer at Whalley Asylum 471 applications have been received by the Asylums Board, and the successful candidate is MR. FRED RILEY, at present power superintendent at the Rawtenstall Corporation electricity works. The salary is £275.

Since our "War Items" went to press news has reached us to the effect that MR. C. MAURICE DOWN, son of Mr. F. J. Down, who

has been connected with the electrical industry for so many years, has been injured in action at the Front and he is now in a London hospital (Lady Mason's), doing well. Mr. Maurice Down, who is a sub-Lieut. in the 1st Hertfordshire Regiment, arrived in France on November 6th, and reached the base two days later. His regiment was soon in the trenches supporting the brigade of Guards, and eight days of bad weather was experienced. Mr. Down was shot on November 19th, his hand and wrist being smashed. It is expected that he will soon be ready to return to France.

Obituary.—MR. W. ADAMS.—The death has taken place of Mr. W. Adams, who was in business as an electrican at Ashdown Road, Kingston-on-Thames, for about 18 years.

NEW COMPANIES REGISTERED.

Jersey Electric Lighting and Power Co., Ltd. (138,351).—For Druce, Walker & Co., Ltd., on p. 731 of our last issue, read Durell, Walker & Co., Ltd.; and for S. N. Druce read S. L. Durell.

London Battery and Manufacturing Co., Ltd. (138,393).—This company was registered on November 23rd, with a capital of £100 in £1 shares, to carry on the business of manufacturers of electric refill batteries for pocket and other lamps. The subscribers are: W. T. Clarke, 8, New Oxford Street, W.C., electrical engineer, 50 shares; R. W. Gale, 259, Goldhawk Road, W., clerk, 25 shares; W. H. R. Hargrave, 24, John Street, Bedford Row, W.C., solicitor, 25 shares; private company. The number of directors is not to be less than 3 or more than 5; the first are W. T. Clarke, R. W. Gale (chairman), and W. H. R. Hargrave. Qualification £5. Registered office: 17, 19 and 21, Emerald Street, Theobald's Road, W.C.

Thomson-Bennett (Magneto) Ltd. (138,397). — This company was registered on November 23rd, with a capital of £5,000 in £1 shares, to carry on in England and elsewhere the business of manufacturers of electrical and other component parts, accessories and fittings used in the construction, starting, running, driving and regulation of stationary engines or motor vehicles for use on land, water or in the air, etc. The subscribers (with one share each) are: W. E. Godfrey, 9, Kingsley Road, Sparkbrook, Birmingham, clerk; G. E. Mason, 9, Drews Lane, Ward End, Birmingham, clerk; private company. The number of directors is not to be less than 2 or more than 5; the subscribers are to appoint the first. Qualification, 1 ordinary share. Solicitors: Dale & Co., Birmingham. Secretary: W. H. Hughes. Registered office: "Arden Works," Cheapside, Birmingham.

Midland Magneto Co., Ltd. (138,430).—This company was registered on November 26th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers and agents for and dealers in magnetos, accumulators, dynamos and motor and other engines, electricians, machinists, etc. The subscribers (with one share each) are: W. T. Church, 116, Golden Hillock Road, Small Heath, Birmingham, secretary; E. A. Simpson, 1, Cheddar Road, Balsall Heath, Birmingham, clerk; private company. The number of directors is not to be less than 2 or more than 5; the subscribers are to appoint the first. Qualification 50 shares. Solicitors: Jeffery, Wild & Lovatt, 95, Colmore Row, Birmingham.

Acetylene and Carbide, Ltd. (4,206).—This company was registered in Dublin on November 26th, with a capital of £500 in £1 shares, to carry on the business of manufacturers and sellers and buyers of electro-chemical products, electricians, mechanical engineers, etc. The subscribers (with one share each) are: C. Bingham, 11, Queen Victoria Street, E.C., merchant; A. S. Young, 11, Queen Victoria Street, E.C., merchant; private company. The number of directors is not to be less than 3 or more than 7; the first three are to be appointed by the subscribers. Registered office: City Chambers, 143, Royal Avenue, Belfast.

N. I. Z., Ltd. (138,421).—This company was registered on November 25th, with a capital of £6,000 in £1 shares, to carry on the business of electro-chemists, platers and typers, metallurgists, electricians, electrical engineers, etc. The subscribers (with one share each) are: B. Baines, 17, Green Street, Leicester Squqare, W.C., solicitor; C. W. Denny, 22, Edwardes Square, W., engineer; private company. The number of directors is not to be less than 2 or more than 5; the first are not named. Qualification 100 shares. Registered office: 1-2, Old Pye Street, Westminster, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Vaughan and Son, Ltd. (61,526).—Capital, £50,000 in £1 shares (20,000 preferred). Return dated September 25th, 1914. 16,580 preferred and 26,789 ordinary shares taken up. £43,369 paid. Mortgages and charges, £5,000.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Acknowledgment of further indebtedness dated 10th November, 1914 (supplemental to trust deed dated 16th October, 1913), to secure £100,000 5 per cent. debenture stock ranking pari passu with £400,000 like stock secured by principal deed, charged on electrical undertakings and lands and company's undertaking and other assets, present and future, except uncalled capital. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

Chipping Norton Electric Supply Co., Ltd.—Particulars of £4,000 debentures, created 10th November, 1914, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

H. W. Smith and Co., Ltd. (123,953).—Capital, £5,000 in £1 shares. Return dated October 5th, 1914. 3,200 shares taken up; £1,200 paid; £2,000 considered as paid. Mortgages and charges: Nil.

Hydro-Electric Co. Concessions, Ltd.—Further charge on company's uncalled capital dated 25th November (supplemental to mortgage dated June 29th, 1914) to secure £250. Holders: Coutts & Co., 15, Lombard Street, E.C.

Suffolk Electricity Supply Co., Ltd.—Issue on 24th Sept., 1914, of £625 debentures, part of a series of which particulars have already been filed.

Yarmouth (I.W.) Electricity Supply Co., Ltd. (56,884).—Capital, £5,000 in £5 shares. Return dated April 14th, 1914. 361 shares taken up; £1,805 paid. Mortgages and charges: Nil.

Dick, Kerr and Co., Ltd. (63, 407).—Capital, £650,000 in £1 shares (350,000 preferred). Return dated October 29th, 1914. 305,000 preference and 260,000 ordinary shares taken up; £565,000 paid. Mortgages and charges: £236,930.

Feld Bros. and Co., Ltd. (105,577).—Capital, £5,000 in £1 shares. Return dated October 1st, 1914. 1,404 shares taken up; £1 per share called up on 404 shares; £404 paid; £1,000 considered as paid on the remainder. Mortgages and charges: Nil.

Bat Meter Co., Ltd. (99,327).—Capital, £20,000 in £1 shares (12,000 preferred). Return dated August 8th, 1914. 10,683 preferred and 8,000 ordinary shares taken up; £1 per share called up on 423 preferred and 15s. per share on 10,260 preferred; £8,118 paid; £8,000 considered as paid on 8,000 ordinary shares. Mortgages and charges: Nil.

Electric Supply Co. of Victoria, Ltd. (66,059).—Capital, £325,000 in £1 shares (175,000 preferred). Return dated September 24th, 1914. 170,375 preferred and 125,000 ordinary shares taken up; £1 per share called up on 45,382 shares; £45,382 paid; £249,993 considered as paid on the remainder. Mortgages and charges: £163,066.

CITY NOTES.

Fraser & Chalmers, Ltd.

MR. A. W. TAIT presided on November 26th at the annual meeting held at Winchester House, E C. He said that the net profit for the year was £8,377, as compared with £4,604 in the preceding year, and although the amount could not be regarded as satisfactory, the progress was encouraging. The works at Erith had been fairly well employed, though there had been some falling off in certain departments during the close of the period. Considerable progress had been made in the manufacture and sale of steam turbines and turbo-blowers, and their machines were well able to compete with those of other manufacturers in the same line of business, both in efficiency and cost, and there were reasons to believe that the department would steadily grow in importance. There was little to report with regard to gas and oil engines, but in coal-handling and conveying machinery their business had increased. In the manufacture of mining machinery, business had not been so good, and the prospects were not bright. In South Africa general business had been well maintained; in Canada the results were not so satisfactory as in the previous year, and business might be dull there for some time to come. Their Australian business showed encouraging improvement. After the outbreak of war there was a falling off in the number of orders, and inquiries for Erith manufactures, but lately there had been a better tone, but they could not expect the normal volume of business during the current year. They were now executing work for the War Office, and hoped to do some for the Admiralty, and they were seriously looking into the prospects for their manufactures which would be opened up in Russia after the war.

Cordoba Light, Power and Traction Co., Ltd.—After providing for debenture interest, &c., the accounts for the year to September 30th show a profit, including £23,501 brought forward, of £44,321. After paying the dividend on the preference shares, £26,321 is carried forward.

Barcelona Traction, Light and Power Co., Ltd.—The board have decided to suspend for the present the payment of the half-yearly coupon due December 1st on the 5 per cent. 50-year first mortgage bonds, as the war has rendered it impossible to continue the arrangements which were made in June last with a financial group for providing the funds required for and during the completion of the company's present programme of construction. The board, however, have under consideration a plan which would provide the company with the necessary funds for continuing and completing the works under construction, and for the adjustment of maturing interest. The completion of these works, it is stated, will produce a revenue more than sufficient to meet the bond and interest charges. The enterprises of the company at present in operation show satisfactory results with a steadily increasing revenue.—*Financial Times.*

Venezuela Telephone and Electrical Appliances Co., Ltd.—The accounts for the year ended June 30th last show a profit, including £8,728 brought forward, of £24,677. After providing for interest on loans and debentures, the directors recommend a dividend of 10 per cent. on the preference shares on account of arrears and the transfer of £6,000 to reserve for renewals and depreciation, leaving £10,434 to be carried forward. —*Financial News.*

Callender's Share and Investment Trust, Ltd.—A financial daily states that the accounts for the year ended August 31st show a profit after providing for debenture interest, &c., and including £2,617 brought forward, of £11,192. The directors recommend a further dividend of 2½ per cent., making 5 per cent. for the year, and the transfer of £500 to reserve, leaving £2,921 to be carried forward.

Stock Exchange Notice.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Montreal Light, Heat and Power Co.—Further issue of $1,800,000 capital stock (Montreal Certificates).

R. & J. Dick, Ltd.—The accounts for the year to August 31st show a net profit, after writing off £6,041 for depreciation, and including £11,473 brought forward, of £70 964. £15,000 is applied in reduction of goodwill, £10,000 to preference dividend reserve fund, and a dividend of 5 per cent. on the ordinary shares is recommended, leaving £10,363 to be carried forward.

Mackay Companies.—The regular quarterly dividend of 1¼ per cent. on the common shares is announced.

West India and Panama Telegraph Co., Ltd.

The report for the six months ended 30th June, 1914, showed that the amount to credit of revenue was £41,482, against £45,524 for the corresponding half-year of 1913, and the expenses were £26,900 against £26,261. The balance was £14,582, plus £1,724 interest on investments, and £1,905 brought forward, making an available total of £18,212. Dividend on the first preference shares, six months to 30th June, 6s. per share, absorbs £10,369; second preference dividend, six months to 30th June, 6s. per share, £1,401; dividend on the ordinary shares, 1s. 3d. per share (free of income tax), £5,520; leaving £922 to be carried forward. The traffic receipts show a decrease of £4,482, arising to a great extent from the competition at Porto Rico referred to in the last report. In the directors' report for the corresponding period of last year it was stated that negotiations were pending with the Imperial and Canadian Governments for a reduction of rates in return for subsidies. The result of these negotiations is that the Imperial and Canadian Governments have granted a joint subsidy of £16,000 a year for ten years on terms and conditions fully set out in a Parliamentary paper. The subsidising Colonies in the West Indies have also agreed to renew the local subsidies of £10,300 for a like term of years. The contract giving effect to these arrangements was sealed on the 10th August and ratified by the House of Commons on the 26th August; and the reduced rates came into operation on the 1st October, from which date the new subsidy of £16,000 a year will become payable. The Danish Islands of St. Thomas and St. Croix have also renewed their subsidies, amounting to £800 a year, for a period of ten years, in consideration of a reduction in tariffs, which became effective from the 1st October. The directors propose to subscribe 200 guineas to the Prince of Wales's National Relief Fund.

Mr. W. B. Kingsford (Chairman) presided at the annual meeting, at Winchester House, on November 25th. In moving the adoption of the above report, the Chairman first referred to the retirement of Mr. R. T. Brown, the manager and secretary, through ill-health, after an almost continuous service of 40 years. The directors wished to place on record their high appreciation of the faithful and valuable services he had rendered to the company both at home and abroad. He was sure the shareholders and the staff would share in the regret felt by the board in Mr. Brown's retirement. They had appointed Mr. Quick, the company's accountant, to be manager and accountant, and Mr. J. Winser to be secretary. Both of these officials had had about 40 years' experience of the company's affairs. As was stated at the half-yearly meeting, it was thought desirable that he should visit the company's stations in the West Indies, as he had not been there since 1904. Several important matters connected with the company's interests were under consideration in the various colonies, and it was felt that these could be satisfactorily dealt with personally rather than by correspondence. He visited the Isthmus of Panama, Demerara, and all the islands with the exception of Gaudeloupe, and they would be glad to hear that his visit was a satisfactory one. He had little to comment upon in the accounts. The traffic receipts exhibited a decrease of £4,482. A considerable percentage of the falling off was owing to the less general activity in Porto Rico and the competition in the telegraphic business on that island. On the debit side of the accounts the expenses were £26,900 as compared with £26,260 in the corresponding period of 1913, an increase of £640, or about 2.4 per cent. It would be noticed that this increase in the expenses was more than accounted for by one item alone, *viz.*, the extra cost of cable used in repairs, which amounted to £2,096, as compared with £1,217. They would have noticed the paragraph regarding the result of the negotiations with the Imperial and Canadian Governments for the reduction of rates in return for an increase of subsidies. Both the reduction in rates and the increase in subsidies came into operation on October 1st, and it was too early yet to say what the result of the first month's working would prove to be. It was likewise impossible this time to forecast, as he usually did, the result of the traffic receipts for the current half-year up to the present time. He might say, however, that for the month of July they were about the same as for July last year. In August and September, owing to the war, the volume of traffic was very largely in excess of the corresponding months in any previous year since the Spanish-American War of 1898; but until their returns were received and they had cleared accounts with connecting companies it would be somewhat haphazard to say what the effect would be in £ s. d. They could, however, reasonably hope that for these two months the increase would be a satisfactory one. On the other hand, their working expenses would be in excess of what they usually were. Their British stations were practically taken over by the Government, and were required to be kept open day and night without intermission, and as their staff was only large enough to deal with the traffic of an ordinary working day of eight hours much overtime had been imposed upon their clerks, for which they had agreed to pay them. They would readily understand that the strain upon their officials was great, and he could not speak too highly of the willingness with which they had accommodated themselves to the unusual circumstances that had been forced upon them.

Mr. G. Von Chauvin seconded the motion, and it was carried.

Provincial Tramways Co., Ltd.

Mr. Andrew Beattie, D.L., J.P., presided, on Friday last, over the annual meeting held at the offices, Moorgate Station Chambers, E.C.

In proposing the adoption of the report, the Chairman, after referring with regret to the loss the company had sustained in the death of Mr. John Glenn, who had been connected with the company as a director almost since its foundation, said that the profits for the year amounted to £40,297. That was a little less than a year ago, but under present circumstances he thought it might be considered as satisfactory. On the 1st August last the receipts were some £4,534 in excess of 1913; on the 4th August war was declared, the result of which was an enormous decrease in the daily receipts, which lasted until the end of the financial year. These decreases had to be deducted from the increase they had on August 1st, which reduced the £4,534 to only £1,623. He asked them not to find fault with the directors for this, but to place the blame on the real culprit—the Kaiser. In place of having an increase of £6,000 to £7,000 that they would have had if war had not taken place, the increase was reduced to £1,623, which they looked upon with complacency. With regard to the balance sheet, the reserve and depreciation account showed an increase of £5,059, after making the necessary writings off the various local companies' accounts. There was an increase of £2,000 in the reserve for third party insurance, and a decrease of £542 in the net revenue account. Referring to the proposed distribution of the profits, he regretted that they did not see their way to pay 8½ per cent. as they did last year. They believed it more prudent to reduce the dividend to 7½ per cent. and to increase the carry-over. They did not know what was in store for them, and the slight reduction was very little taking the present position into consideration, and having regard to what other trading companies were doing. They had spent a considerable amount on the permanent way, plant and buildings—£6,000 during the year—as it was important to keep the property in a state of efficiency. Their entire rolling stock, permanent way, and other property was well maintained, and had it not been for the war this would have been by far the best year in the history of the company. As to the future, no one could tell what might happen. Many rumours were afloat, but so far as they could judge, after a few months they might hope to enjoy peace and quietness once more. The money spent, by reason of the war would have to be paid by the nation generally, and they would do their part gladly. As to the future, he was glad to tell the shareholders that since the 1st October last they were roughly £2,000 better off in receipts than in the corresponding period of last year. They were working the concerns as economically as possible, and although there were certain unavoidable increases in wages and other items of expenditure, it was pleasing to know that the increased traffics were more than sufficient to meet these, and, at the same time, to leave something substantial in hand for the shareholders. They hoped next year to meet them with a good balance sheet, but much depended upon the speedy termination of the war.

Mr. S. Horn, in seconding the motion, said he thought they must all agree that, seeing how they had been handicapped by the war during the best two months of the year, the results were very satisfactory. The shareholders must not go away with the idea that, because up to the moment they had done very well so far this year, the year on the whole was going to be anything like as good as its predecessor. He was afraid they would feel the effects of the war very seriously in the current year, both as regarded increased expenditure and decreased traffics. If, therefore, the dividend was considerably reduced next year they must not be disappointed.

The report was adopted.

Subsequently a resolution was unanimously passed approving of the action of the directors in contributing £210 to the Prince of Wales' National Relief Fund.

Mexican Light and Power Co.—The board states **that the condition of affairs in Mexico shows no sign of improvement, and it has no alternative but to defer the payment of the half-yearly coupon due December 1st next on the 6 per cent. second mortgage 50-year bonds.**

Brazilian Traction, Light and Power Co., Ltd.— **A dividend of 1½ per cent. for the three months ending December, on the 6 per cent. pref. shares, is announced.**

Central Electric Supply Co., Ltd. — Warrants for **interest on the 4 per cent. guaranteed debenture stock for the half-year to November 30th have been posted.**

British Electric Traction Co., Ltd. — The directors **have declared the dividend on the 6 per cent. cumulative preference stock for the half-year ended September 30th.**

Canadian General Electric Co., Ltd.—A quarterly **dividend of 1¾ per cent. is announced on the common stock for the three months ending December 31st.**

STOCKS AND SHARES.

Tuesday Evening.

The pouring rain of the first part of the week made Stock Exchange men more emphatic than ever about the necessity for re-opening the House, and allowing them to get back to their accustomed haunts, in order that they might be able to deal with at least a shelter over their heads. Official announcement may be made at any time—possibly before these pages are in print—as to the date at which the Government will sanction the re-opening of the Stock Exchange. Arguments for and against the demand have been ventilated in these columns previously, but the latter kind are greatly undermined by the incessant liquidation provided by the elements.

So far as prices are concerned, there is a cheerful sentiment permeating most of the markets. Thanks to the Russian successes on the Eastern frontier of Germany, it is assumed that the pressure on the Western must be sensibly relaxed by the enemy, which would allow the Allies to make a further advance into Belgium. The success of the War Loan contributed to the strength of markets, inasmuch as it demonstrated the confidence of the investor. That the loan was not greatly over-subscribed is considered certain in City circles; and the generally-accepted estimate is that 353 million pounds sterling was applied for, this being three million pounds more than the Government offered.

The country is now comfortably provided with funds wherewith to carry on the war until the end of next July, if necessary. Germany has spent the 250 millions, for which she obtained a vote of credit some time ago, and which has been issued partly in treasury bills, partly in a war loan. The condition of French finance is a subject of some perplexity and discussion, but, so far, the only country to raise a forced war loan has been Holland, if we except the contributions levied upon Belgian cities by the savage interlopers, who will have to pay heavily, by way of indemnity, for their raids upon Belgian coffers.

The obscuring of London's lights shows no signs of diminution, and every week this bring fresh inquiries of shareholders in electric supply companies, who ask rather anxiously what is likely to be its effect upon individual concerns. These proprietors must be prepared to see some comparatively small decline in the profits made by their companies; and if dividends are to be reduced, it is one of those incidents, arising from the fortunes of war, which cannot be helped. Most of the undertakings have some compensation to set off against their loss of profits from illumination.

Street lighting is not a matter which need give shareholders any particular cause for uneasiness, because this branch of the business, as a rule, is one useful more for advertisement than for anything else; and while gross receipts will be affected, the profits are cut so fine that, in net, the effect will be trifling. The City companies have large customers for power, the County of London especially so; and they should be doing well from this branch of their business. The West End undertakings should get a certain amount of compensation from their loss of club and shop lighting through the medium of increased consumption of current in nearly all the big public offices. How long the Admiralty are going to keep the lights turned down nobody seems to know; but if the regulations are as stringently enforced for the next few weeks as they are at present, they will act very detrimentally to Christmas shopping and trade.

The Admiralty and the Metropolitan Special Constabulary have men posted for observation purposes every night on various high points and buildings round London, and from these lofty *pieds-en-l'air* the view in the small hours of the morning is singularly beautiful, now that the lights are turned low in the streets beneath. The deep shadows and the profound silence fill the watcher with a sense of mystery and solemnity. Everything looks so peaceful that it is difficult to believe he is vigilantly standing there because Europe is convulsed in a vortex of war among the nations. At the same time, the steady light of the lamps which are on active service seems to proclaim the City to be watchful in its calmness; and, as he sweeps the horizon with his glasses, he knows there is the invisible companionship of many other men sharing his vigil, sharing, probably, his very material wish that electric radiators might be fitted to lonesome observation points when his country is at war in winter-time.

Inasmuch as a good idea is always worth copying, it may be mentioned that in some parts of London, at least, the gas people are sending to householders letters stating that a representative will call to inquire whether the gas apparatus in use is satisfactory. The representative will furnish advice as to the best method of lighting and warming any particular room, as to the use of gas cooking stoves, or the best way in which to obtain hot water; and the letter asks for an interview, a post-card being enclosed for the householder to say what time and day would suit him best for the appointment. That enterprise of this sort is profitable and effective there can be little doubt; and those electric lighting companies whose men are, perhaps, not fully employed all day, might consider the advisability of undertaking a more thorough and systematic canvass than they have done in the past.

Our price lists this week contain comparatively few changes. There are no alterations in the quotations for Home electricity supply shares, although much interest attaches to the publication of the Parliamentary Bills of the London County Council and of the companies. The L.C.C. Bill was published at the end of last week, and its 54 clauses cover virtually all the ground that there is in connection with the supply of electricity to London. The central idea is to establish what is called The Electricity Authority for the development and working of supply within the very wide area defined in the Bill. The companies, on their part, are presenting two Bills—one very short, the other lengthier—the intention of both being somewhat the same as that contained in the L.C.C. Bill, though conceived on more modest lines. Parliament now being up until the early spring of next year, the matter will continue in abeyance for probably three months.

The following is the list of prices of representative stocks and shares in various electrical markets:—

Home Electricity Supply Companies.

Brompton Ordinary	8⅜	Kensington Ordinary	7⅞
do. 7 per cent. Pf.	8⅜	London Electric	1¼
Charing Cross Ordinary	4¼	do. do. 6 per cent. Pf.	5
do. do. do. 4½ Pf.	4¼	do. do. 4 Deb.	89½
do. do. City Pf.	4¼	Metropolitan	3
do. 4 Deb.	86½	do. 4½ per cent. Pf.	4¼
Chelsea	4⅜	do. 4½ Deb.	91½
do. 4½ Deb.	91½	do. 3½ Deb.	81½
City of London	15	St. James' and Pall Mall	9
do. do. 6 per cent. Pf.	13	do. do. 7 per cent. Pf.	6⅜
do. do. 5 Deb.	115	do. do. 3½ Deb.	83
do. do. 4½ Deb.	98	South London	3
County of London	11⅛	South Metropolitan Pf.	1⅛
do. do. 6 per cent. Pf.	11⅛	Westminster Ordinary	8⅛
do. do. 1st Deb.	99	do. 4½ Pf.	4⅛
do. do. 2nd Deb.	97		

Manufacturing Companies.

Brit. West. Pf.	1½	Electric Construction	11s.
do. 4 Deb.	72	do. do. Pf.	1
do. 6 p. lien	98	Gen. Elec. Pf.	10
Callenders	11½	Henleys	12½
do. 5 Pf.	4⅝	,, 4½ Pf.	4⅜
do. 4½ Deb.	97½	,, 4½ Deb.	97½
Edison & Swan, £3 pd.	6/-	Telegraph Con.	36⅛
do. do. fully pd.	1⅛	Castner-Kellner	2⅛
do. do. 4 Deb.	60		
do. do. 2nd Deb.	60		

Telegraphs and Telephones.

Anglo-Am. Tel. Pf.	103½	Gt. Northern Tel.	29½
do. Def.	21	Indo-European	58
Chili Telephone	7	New York Tel. 4½	96½
Constantinople Tel.	4½	Oriental Tel. Ord.	2
Cuba Sub. Ord.	8½	do. Pf.	1⅛
do. Pf.	15½	Tel. Egypt Deb.	97
Eastern Extension	11⅝	United R. Plate Tel.	6
do. 4 Deb.	94	do. Pf.	5
Eastern Tel. Ord.	122½	West India and Pan.	1⅛
do. 3½ Pf.	72½	Western Telegraph	12⅜xd
do. 4 Deb.	95	,, 4 Deb.	95½
Globe Tel. and T. Ord.	10¼		
do. Pf.	12⅜		

Foreign Trams, &c.

Anglo-Arg. Trams 1st Pf.	4½	Bombay Electric Pf.	11
do. 2nd Pf.	4⅜	do. 4½ Deb.	96
do. 4 Deb.	86½	Mexico Trams.	50
do. 4½ Deb.	95½	do. 5 per cent. Bds.	70
do. 5 Deb.	88½	do. 6 per cent. Bds.	70
Brazil Tractions	54	Adelaide Sup. 6 per cent. Pf.	5⅞
		do. 5 Deb.	104½

Edison & Swan partly-paid shares are better at 6s., but the Second Debenture stock has fallen several points to 60. Henley's at 13¼ have been marked down, the buyer who appeared at the end of last month getting his shares. Telephone and Telegraph issues are firm, with an improving tendency. Anglo-American Preferred put on two points at 103½. Marconis vary little, keeping about 31s.

Brazil Tractions rose to 55, before reacting to 54, this price leaving them 2½ up on the week. There is a shortage of shares—perhaps more apparent than real, because it seems likely that the supply would be considerable were it not held back with some definite object. Mexico trams are flat, because of the high-handed action of the Mexican Government in raising the employés' salaries 25 per cent. and at the same time forbidding export of the company's funds. The Mexican Light and Power group is also weak, and prices have again become nominal. There is nothing of fresh interest to record in Canadian securities.

The Debenture stocks of the following companies are wanted at the present moment, and can be placed on reasonably good terms. There is no floating supply, and buyers want the Debenture stocks of the:—

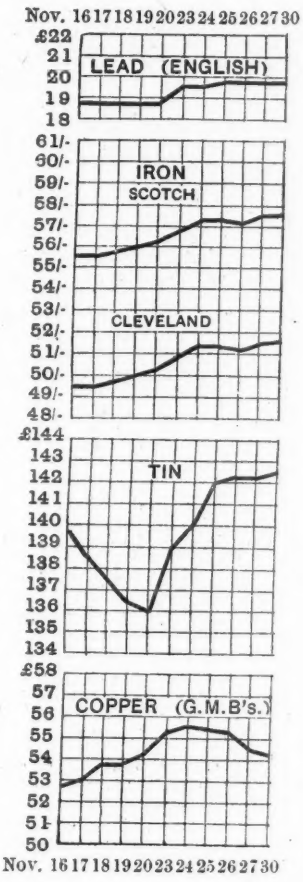
Anglo-Argentine Trams.		City of London Electric.	
Auckland	,,	General	,,
Brisbane	,,	Melbourne	,,
Calcutta	,,	Para	,,
Central Electric Supply.		St. James's	,,
Charing Cross Electric.		South London	,,
Chelsea	,,	Westminster	,,

Rubber shares are good. A number of advances have occurred within the past few days in the leading issues, and, to bear covering, there has been added a moderate investment demand. The copper market is quiet, but tin is coming to the front again, and various tin shares have responded to the improvement in the price of the metal. The Armament group keeps steady, without noticeable alteration in the leading shares; but in some of the other engineering companies, whose shares have until lately been almost unsaleable, there has recently arisen a quickened public attention.

Mexico Tramways Co.—The *Financial Times* stated last week that the London office of this company had been notified that the Mexican Government had increased the wages of all the tramway employés by 25 per cent., and had also forbidden the remittance of further funds abroad until the rate of exchange improved. Urgent representations to the Mexican Government were being made.

METAL MARKET.

Fluctuations in November.



The Metal Market re-opened for official transactions on Nov. 16th.

A Large Supply Undertaking.—The Rhenish-Westphalian Electricity Works Co., of Essen, is a great undertaking which, together with its associated companies—the Berggeist works, of Bruhl, the Bergische works, of Reisholz, and the Bergische works, of Lennep—furnishes a supply over a superficial area of 4,340 sq. miles, having a population of 2,800,000 persons. The enterprise is partly of the pit-bank class, as one of the stations is located at a colliery, and this explains to a large extent the fact that the company also supplies coke oven gas for illuminating purposes to a number of districts, the total length of the network of gas mains now being nearly 120 miles. Apart from this circumstance, the company has a specially large power load quite independently of the delivery of energy to various tramway companies in which the Essen Co. is financially interested. During the year ended June 30th, 1914, the number of connections of the company and its associated works increased by 95,000 KW. to 320,000 KW., and the Essen Co. alone was responsible for 179,931 KW. of the total KW. connections. The turnover of the combined works advanced from 236,321,000 KW.-hours in 1912-13 to 290,048,000 KW.-hours in 1913-14, and the respective consumption for lighting, power and tramway purposes is certainly remarkable. For instance, the lighting supply only absorbed 27,568,775 KW.-hours in 1913-14, and the tramways 14,313,221 KW.-hours, whereas the consumption for general power services, with 34,000 motors connected, as contrasted with 23,000 motors in 1912-13, amounted to the formidable total of 248,166,004 KW.-hours. These figures show the exceptional demand which has been made upon the principal and subsidiary companies on the part of manufacturers who carry on business in that part of the country. In addition, the consumption of gas reached 24,702,000 cb. metres. The final result of the Essen Co. for the past year is the record of net profits of £209,000, on a capital of £2,500,000, as compared with £169,000 in 1912-13, and the payment of a dividend of 8 per cent., as in the preceding year.

INSTITUTION OF ELECTRICAL ENGINEERS

(*Abstract of* Inaugural Address *delivered to the* Newcastle Local Section *by the Chairman*, Mr. P. V. Hunter, *Nov. 16th*, 1914).

The tendency of engineering development in the production and transmission of electrical energy is in the direction of working on a large scale. As this tendency is due to economical advantage which can only be obtained in this way, and as it persists in spite of obstacles other than engineering, it is to be expected that the size of generating plant and the radius of transmission systems will continue to increase. In the construction and operation of such large generating stations and supply systems engineering problems necessarily arise which are not apparent in smaller systems, although the only obvious difference may be that of size. One of the most interesting phenomena which becomes of greater practical importance proportionately with the size of system is the mechanical forces experienced by circuits carrying heavy currents.

If two conductors carrying current are brought parallel to each other they both experience mechanical stress and are either attracted or repelled according as the currents are flowing in similar or opposite directions. A single conductor arranged in the form of a ring and carrying current experiences a stress tending to increase its periphery, *i.e.*, similar to centrifugal force. If the conductor be formed into a helix the effect of current is to expand the helix in diameter and compress the turns towards each other in an axial direction.

As the magnitude of all such stresses is proportional to the square of the current, they may, while quite inappreciable with normal currents, be of serious moment in the event of an abnormal rush of current amounting to many times normal load. There is no difficulty or material additional cost involved in completely guarding against these mechanical stresses.

The stresses were first experienced as a matter of practical importance in the end windings of turbo-alternators.

The primary precaution is to brace the end windings in a manner enabling them to withstand the mechanical forces. With the object of reducing the magnitude of the forces, reactance coils in series with the generator windings have been adopted, and are recommended where the generators are wound for the pressure of transmission. It is, however, more usual at the present day to transmit at pressures for which generators cannot be satisfactorily wound, and in such cases a more satisfactory arrangement is to use a step-up transformer directly connected to the terminals of each generator incorporating a substantial amount of reactance in the transformer windings. An impedance of 12 per cent. at full load can be satisfactorily obtained in a transformer without extra cost and without the use of iron in the leakage paths. Such an arrangement gives a combination in which the maximum instantaneous value of the short-circuit current is six or seven times full load and the corresponding mechanical forces can be readily dealt with.

A breakdown in the reactance coils or transformers may produce the troubles they are calculated to mitigate, namely, an instantaneous short-circuit across the generator terminals. No commercially effective proposals have to my knowledge been suggested for incorporating substantial additional reactance in the generator stator windings themselves.

There is, however, a tendency on the part of designers to depart from windings having one bar per slot. With two conductors per slot there is an increase of stator reactance and corresponding reduction of the maximum value of the short-circuit current. In the later arrangements each conductor is independently insulated, and the insulation between conductots is double that between conductors and earth. This precaution largely eliminates one of the principal troubles which discredited earlier windings having a number of conductors per slot, namely, failure of insulation between conductors.

There are still objections to multiplying the number of conductors per slot, and it is distinctly advisable to restrict the number to two wherever possible.

Of all electrical apparatus the transformer is that which is in a position to be subjected to the greatest mechanical stress; the short-circuit current may easily be 40 times full load. Fortunately, transformers are more readily braced against the mechanical stresses involved, and there is no real difficulty in constructing a transformer which will not suffer damage under short-circuit. This applies to all ordinary constructions, whether shell or core type, single-phase or three-phase.

A transformer having a full-load impedance of 2½ per cent. and giving a voltage variation from no load to full load at ordinary power factors of approximately 2 per cent. is a satisfactory one from all points of view. Its voltage variation is sufficiently good for all ordinary purposes and the stresses on short-circuit can be properly guarded against by bracing the coils and without materially increased cost.

The value of the short-circuit current is usually deduced from a test in which the secondary of the transformer is short-circuited and sufficient voltage applied to the primary to circulate full-load current. The value of the voltage so obtained divided into the normal primary voltage will give the number of times full-load current which should be passed by the transformer under short-circuit conditions with full primary

voltage maintained. This assumption is only true if the leakage flux traverses a path which is air or its equivalent.

It has also been found from experience that although a transformer may be so constructed and braced that when first installed it is fully capable of withstanding a short-circuit, it may not be in this condition after it has been in service for a few months. This particularly applies to oil-cooled transformers. The coils settle down and the settlement leaves the coils free to move, with destructive results in the event of a heavy short-circuit. It is therefore a wise precaution to examine each transformer after it has been in commission for a few months and tighten all anchoring bolts.

The majority of transformers manufactured to-day have inadequate provision against the mechanical stresses of short-circuit. That more trouble is not experienced is no doubt almost entirely due to the fact that the generating plant is not able to maintain full primary pressure on short-circuit. This protection will disappear with the growth of the generating system.

Many current transformer failures if properly traced to their source are due to mechanical movement of the primary coils under a heavy rush of current. The soundest arrangement is decidedly that in which the primary consists simply of a bar without turns. Such transformers do not maintain their ratio if at all heavily loaded on the secondary side, but it is

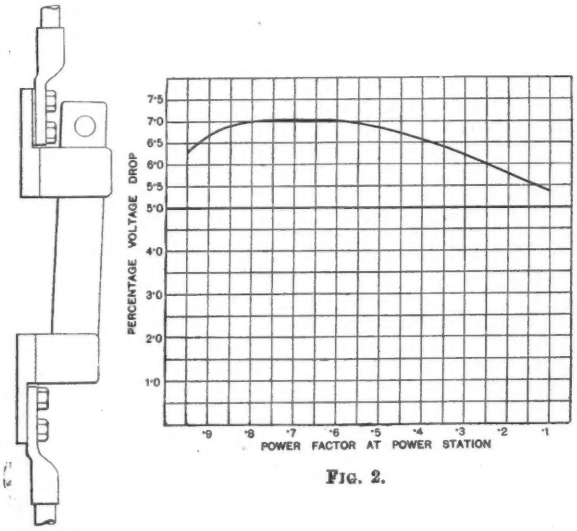


Fig. 2.

Fig. 1.

generally possible to use them almost exclusively on large switchboards. Their reliability is so far superior to that of any other type that they should undoubtedly be used wherever possible.

One curious effect of the mechanical stresses accompanying the flow of current is the tendency of knife-type disconnecting switches to open automatically under a heavy rush of current. The effect is similar to that which tends to increase the perimeter of a conductor forming a closed loop and does not exist if the conductors above and below the switch are in line with it. It is, however, remarkable how small a deviation from a straight line is required to give this action. The accompanying fig. 1 is a scale drawing of a disconnecting switch which, under a severe short-circuit, opened automatically; if it had not been actually experienced one would, I think, doubt the probability of sufficient force being produced with the arrangement shown to open the switch, as this requires a pull of several pounds.

Even in the case of straight copper connections there may be considerable stress under short-circuit conditions.

As an illustration I will take the case of a line of busbars spaced at 18 in. centres, each individual bar supported at intervals of 3 ft. In the event of a short-circuit between two adjacent bars sufficient to produce a momentary current of 100,000 amperes each busbar support would, according to theoretical calculation, experience a force at right angles to its axis of some 900 lb. 100,000 amperes is a large, but by no means impossible, current; it probably represents the maximum instantaneous short-circuit current of about 50,000 kw. of generating plant at 5,000 volts. The forces are peculiarly destructive as they are of a pulsating nature. The severity of the stress is, of course, increased if the conductor is at all able to move in its fastenings, so that it can deliver a blow to the supports. There is one incidental precaution which may be readily taken when the conductors are in the form of copper strip, and that is to arrange them so that the greatest dimension of each conductor's cross section is in the line of the force. This gives greater rigidity and is an obvious precaution when the need for it is recognised. It is, however, quite common to see such conductors arranged differently.

It is most desirable to reduce the magnitude of the forces, and there is no doubt that a great deal can be done in this direction by the use of reactance. In some cases the indiscriminate use of reactance has been advocated in a manner which, if adopted, would make commercial engineering practically impossible, and in no case has the economic condition introduced by the use of reactance been sufficiently considered.

So far as generators are concerned, the addition of even a comparatively large reactance does not materially affect either the cost of the generator or its efficiency. In the case of reactances between bus-bar sections and on feeders, however, the conditions are different. With reactances between bus-bar sections it is necessary to divide up the transmission system into as many separate networks as there are sections of bus-bar. The need for separating the transmission system into such small networks arises owing to the fact that the inter-connectors between sections would short-circuit the reactance and defeat its purpose; in addition, the inter-connecting cables might suffer serious damage owing to the excessive currents which would flow through them on the occurrence of a bad fault on one of the bus-bar sections. A limited number of inter-connectors may be used if fitted with instantaneous excess-current relays, but this would not relieve each section of the network from carrying a proportion of spare feeders sufficient for its own load.

The division of a H.T. network into small independent sections cannot be too strongly condemned. This will be realised when it is properly recognised that the majority of H.T. networks cannot be laid out economically because they are too small; that is to say, they do not include a sufficient number of feeders covering a sufficiently large area. The carrying capacity of the feeders leaving the majority of the power stations in this country is from two to four times the actual maximum load carried by the power station; this is obviously an excessive amount of spare. The disadvantage of sectioning a network is greater the higher the diversity of the load.

The objection to the use of reactance at the power station end of feeders is the increased effective voltage drop incurred. This depends on the power factor of the load. On unity power factor loads the reactance does not appreciably increase the voltage drop of the feeder, but the tendency in this country is to give supply as alternating-current without conversion and the power factor of the load on individual feeders in general varies from .6 to .8. In such circumstances reactance has a material effect on the voltage drop. I show in fig. 2 the variation in effective voltage drop of a feeder due to a 5 per cent. reactance, the resistance drop of the feeder at full load being assumed as 5 per cent.

It is obvious that on low power factors the permissible length of feeder must be reduced, as this is settled by the drop. The simplest way out of the difficulty is to provide, in addition to the reactance coil, a voltage regulator on each feeder which can be adjusted to maintain the voltage constant at the far end of the feeder under any normal condition of loading.

On the whole, the expense and difficulties introduced by the use of reactance should be avoided as far as possible, and for dealing with mechanical stresses it is first of all desirable to have the apparatus throughout so mechanically constructed as to offer the greatest resistance to damage. Having done this, the aid of reactance should be called in discreetly, using generator reactance as freely as necessary, feeder reactance only when really essential for safety, and bus-bar section reactance not at all, or only in exceptional circumstances on large networks.

CABLES.

By C. J. BEAVER, M.I.E.E.

(*Continued from page 740.*)

In fig. 10 is shown a form of 3-core joint in which all wrappings or sleeves of fibrous insulating material are eliminated, the jointed cores being supported in specially designed porcelain "spacers," made of completely vitrified unglazed porcelain. These spacers, illustrated in fig. 11, are so designed that the two parts of which they are composed may be put together after the joint is made, without straining the cores apart. They are specially shaped to resist any tendency to trap air or gases.

It is found that the effect of the presence of the porcelain spacer on the potential gradient, as regards any tendency to cause electrostatic distortion when the spacer is efficiently embedded in the compound, is negligible.

Electrolytic corrosion of lead coverings has been fairly common, though, thanks largely to the Board of Trade rule as to the maximum permissible potential differences between tramway rails and earth, and also owing to our insular ideas, not to anything like the extent experienced in other countries. Continuity bonding and cross bonding at suitable points on networks has usually been the means of preventing or checking such corrosion.

Surveys for the purpose of finding equipotential points, and otherwise determining the best lay-out of bonding systems, have become the recognised procedure in many large systems. The likelihood of such points altering in course of time with the growth of a network is also appreciated.

Perhaps the worst instances of this form of trouble occur where the effects are brought about by leakage from the cables themselves. The most prolific source of such leakage current is inefficient sealing of "trims" at connections, in conjunction with lack of bonding, whereby local leakage circuits are set up, eventually giving rise to other leakage circuits. The extent to which this disease can develop under conditions of negligent maintenance has to be seen to be credited.

Chemical action is sometimes blamed for the corrosion of lead coverings, a notable instance being that of the wooden

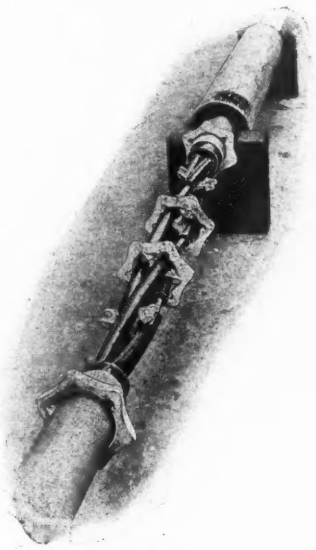


Fig. 10.

bridges which used to be almost universally employed in the solid system of laying cables. The author has examined many cases of this kind which have occurred in this country and abroad, and he has invariably found them to be due to electrolytic action, the wood having formed the path for the current.

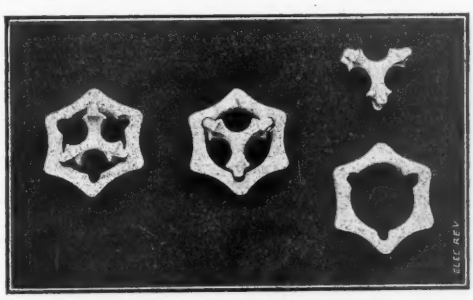


Fig. 11

Apart from very exceptional cases—so exceptional as to be quite distinct from ordinary cable conditions—it may be taken for granted that simple chemical action, as distinct from action assisted by current, is a cause of trouble which may be regarded as negligible with lead-covered cables.

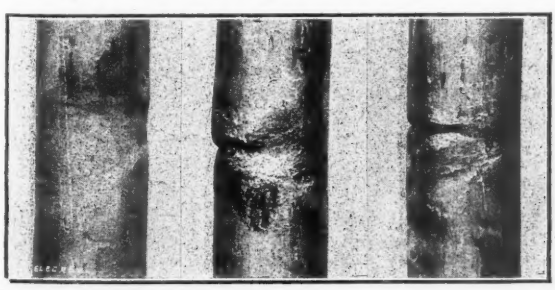


Fig. 12.—Progressive Injury to 1-sq. in. Cable.

Mechanical damage hardly calls for mention, because the various sources from which it may arise are usually obvious. The author's attention was recently called, however, to a type of damage which is of considerable general interest, as it arises from conditions that are of modern growth, and are likely to be encountered in any large town where heavy motor lorry traffic exists.

Within the last two or three years a slowly spreading epidemic of faults of this character has arisen on lead-covered cables laid solid in iron troughs and subjected to the concentrated pounding of the road surface resulting from the accentuated conditions of weight and speed of heavy traffic, and especially where service cables are taken across a street under the roadway. The effect of this pounding is slightly to depress the line of cable and troughing at the least rigid parts, *i.e.*, the joints between lengths of troughing, and in consequence the faults invariably coincide with such joints (fig. 12). It has not been possible to measure the average deflections which occurs, but it is obvious that the actual amount is immaterial, because the effect can be brought about by any degree of the cause, from a single pronounced movement such as may occur in a subsidence of soil, to a long-continued series of minute depressions which might almost be classed as vibrations.

Assuming that it is essential to adopt the solid system of laying cables, preventive measures may be applied in two directions, namely, either with the object of resisting the movement by providing rigidity, or of yielding to it by providing sufficient flexibility. The former methods would entail some such measure as the provision of a substantial concrete bed on which to lay the iron troughing, and the latter the use of non-lead-covered cable in wood or asphalt troughing.

It should be remembered, however, that other methods of laying cables are not so susceptible to this form of damage as the solid system, for the reason that when laid in pipes or ducts or directly in the soil the cable is comparatively free, so that the movement demanded is not concentrated on a length of a fraction of an inch, as it obviously is under the conditions above described.

RUBBER INSULATED CABLES.

The physical properties of vulcanised rubber are fairly well understood and have received much attention from time to time, but efforts to co-ordinate them with electrical properties have not been and cannot be successful, at least in the present state of the art. The reason of this is that maximum strength and elasticity are not compatible with maximum insulation resistance or dielectric strength. Especially is this true as regards the former, as may be judged from the fact that if we modify rubbers specially designed for insulating purposes by introducing into them ingredients which are commonly and satisfactorily used in mechanical rubber goods for the express purpose of obtaining maximum strength and elasticity, we may find that even so small an addition as 0.5 per cent. of certain ingredients may result in a reduction of something like 50 per cent. in the insulation resistance. This in itself might be comparatively harmless, but another extraordinary result from the electrical point of view is that in spite of the physical improvement the molecular structure is so modified by such additions that the insulation resistance falls very appreciably after the cable has been immersed in water for a few hours owing to the absorption of minute quantities of water, whereas insulating rubbers show no such alteration.

A further aspect of the matter is that in rubbers designed purely for insulating purposes it is possible to get peculiar critical stages of vulcanisation, between which there are great differences in the dielectric strength. For instance, it is a comparatively easy matter to vulcanise a thick high-grade rubber dielectric—as used for E.H.T. cables—to a stage at which its insulation resistance would give no evidence, and mechanical tests very little indication, of under- or over-vulcanisation by comparison with standards. Yet its breakdown point may, under such conditions, be only one-fourth of the value obtainable when vulcanisation is carried a little further, or not quite so far. In normal manufacture these critical stages are usually passed.

Working vicissitudes and other factors bearing on the durability of rubber-insulated cables may be divided into three classes, namely, those due to :—

(*a*) The natural deterioration common to all rubber goods.
(*b*) External influences due to working conditions.
(*c*) Internal influences chiefly due to manufacturing conditions.

With regard to (*a*), the rate of natural deterioration is slowest in rubbers made from hard fine Para rubber. Plantation rubber of the same botanical origin (*Hevea brasiliensis*) will undoubtedly in course of time reach the same level in this respect.

Under (*b*) come more or less simple chemical influences, and effects due to leakage current along damp fibrous coverings. These happen largely near ends which are badly trimmed when connections are made. The access of moisture to the strands of a vulcanised rubber cable by way of exposed ends is a fruitful source of trouble. Ordinary variations of humidity of the air may lead to this, even in situations which are apparently dry. Acid products are formed when the moisture comes into contact with the free sulphur which is always present to some extent in the rubber next to the strand, leading to corrosion of the conductor, and resulting in local action on the rubber by the copper salts formed. Powerful oxidizing effects occur on E.H.T. rubber cables where the production of ozone and oxides of nitrogen on the external surface of the dielectric is caused by brush discharges. Preventive measures against any of these external influences are obviously best applied in the form of special coverings. These coverings call for no special

mention here as they are sufficiently well known to most engineers.

With reference to (*c*), the internal influences due to manufacture chiefly relate to the deleterious effect of copper, by its catalytic oxygen-carrying properties, on rubber. It has always been the practice to "tin" copper wires which come into contact with rubber; but the fundamental importance of the perfection of the tin coating appears to have become generally recognised only within the last few years.

The tinning test devised by the author in 1897—in which cycles of exposure of the tin coating to hydrochloric acid and sodium-sulphide solutions consecutively are employed to indicate the comparative value of the tinning, has been in constant use ever since its introduction.

The sodium-sulphide solution should be prepared by dissolving 25 grammes of pure mono-sulphide of sodium in 100 cubic centimetres of water, adding an excess of sulphur and boiling for about one hour with occasional stirring. The solution should then be cooled, filtered, and diluted to the required specific gravity of 1.142. It should be freshly prepared. The preparation of the hydrochloric acid is simply a matter of dilution to the required specific gravity.

With regard to the brightness of the tinning after the vulcanisation process, some darkening of the tin coating (due to the superficial formation of sulphides of tin) must result, and it will be rather more marked in the case of high grades of rubber, owing to the longer time of exposure to the atmosphere of the vulcaniser, than in low grades. In fact, experienced cable inspectors tend to regard a slightly golden tint as the hall-mark of excellence, and to look with suspicion on silvery brightness. For this attitude there are good grounds. The blackening due to sulphide of copper formed on exposed copper is readily distinguishable from discolouration due to tin sulphides.

A rough demonstration of the fact that the sulphides of tin and copper are harmless to rubber, and that the contact with metallic (and, of course, oxidised) copper is the origin of the deterioration in question, can be made very simply by placing small quantities of copper oxide and the sulphides of tin and copper side by side on a sheet of pure rubber and warming for a few hours. The rubber under and around the copper oxide will be rendered soft and tacky, but will be unaffected where in contact with the sulphides of tin and copper. Generally speaking, all the above-mentioned deterioration effects are accentuated by heat. There is no deleterious action between aluminium and rubber.

It will be gathered that as practically all the effects noted under (*a*), (*b*), and (*c*) are superficial, heavy walls of dielectric such as are used in E.H.T. cables will be much more durable than small thicknesses.

VULCANISED BITUMEN CABLES.

The cohesion between the particles of material is much less in vulcanised bitumen than in rubber. This means that such properties as resilience, elasticity, and resistance to tension, compression, and other mechanical strains have considerably lower values in vulcanised bitumen than in rubber.

At very low temperatures (around or below the freezing-point of water) vulcanised bitumen tends to yield to sudden shock in a brittle fashion, breaking with a conchoidal fracture. At medium temperatures up to, say, 100° F., it is a toughly plastic body having considerable resilience and resistance to mechanical stress. At temperatures in the neighbourhood of 100° F. to 130° F. it begins to lose its toughness, and at still higher temperatures its cohesion disappears to a considerable extent, although its resilience appears to be increased.

In any material of this character the rate at which a given kind of stress is applied has a great effect on the result. A material, intermediate as regards softness or hardness, possessing maximum toughness at medium temperatures, wide limits of temperature range, and approximately equal resistance to all kinds of stress at a low temperature, is obviously the most desirable.

Routine physical tests have been devised by the author for the purpose of controlling the uniform maintenance of such a standard under manufacturing conditions. These tests are as follows:—

(*a*) A shock test by which a standard blow is applied to the sample.

(*b*) A bending test applied at a standard rate of speed and at a standard radius.

(*c*) A penetration test constituting a control not only on the material but on tests (*a*) and (*b*) by ensuring that good results obtained from either of them are not due to slight softness.

These three comparatively rough but mutually supplementary tests afford a very delicate check on matters connected with raw materials, manufacturing operations, and processes of manipulation, and these matters in turn have a very decided effect on the uniformity of the electrical results.

Twin and 3-core vulcanised-bitumen cables are more largely used under such arduous conditions as obtain in mining work than other types, and the fact that such cables are made without internal reinforcement by any other material, gives a good idea of the result of close attention to suitable assembly.

With regard to chemical properties, the stability of vulcanised bitumen is remarkable. It may be regarded as comparable with paper insulation in that causes of deterioration are practically always extraneous causes. The material is exceptionally inert to the action of substances of an acid character. It is much more susceptible to the action of alkaline substances. The direct action of such substances is usually, however, only superficial, and even such severe conditions as continual exposure to coalpit waters—which are usually of an alkaline character—have had no appreciable effect on vulcanised bitumen.

The fallacious impression which exists in some quarters, and which has recently been perpetuated in a Board of Trade Report,* that vulcanised bitumen is softened by contact with coal gas, is correct for natural bitumens, pitches, etc., but is decidedly incorrect for vulcanised bitumen.

It is obvious, and moreover well known, that the susceptibility of alkaline attack must have a great influence under continuous-current fault conditions which can produce electrolytic action, because in most soil conditions it is possible not only to form alkaline substances at parts which constitute the virtual negative electrode of the leakage circuit, but to force such substances by osmotic pressure through the dielectric to the negative conductor. Under these circumstances both the direct action on the vulcanised bitumen of concentrated alkaline substances and the aggravated conditions due to the passage of current (producing continuous supplies of deleterious matter and forcing them to the best position for attack) come into play.

This form of secondary deterioration has been dealt with by Messrs. Dick and Fernie in their book on "Electric Mains and Distributing Systems."

From the results of experiments it would appear that a dielectric must first be rendered conducting, for example, by osmotic influences, insipient flaws, damages, or general weakness, before it will allow sufficient current to pass through it to form electrolytic products in its vicinity. In other words, the dielectric does not, under the influence of temperature solely, permit the sequence of events described by the authors above quoted unless incipient fault conditions are first set up.

The author arrived at the conclusion several years ago that there existed a distinct type of deterioration different from the saponification effect described by Messrs. Dick and Fernie as softening. The search for evidence on the point was a slow matter. The result of the investigation of instances in the tropics may be summarised as follows:—

First, they showed that leakage current played a prominent part in bringing about softening of the vulcanised bitumen, and that such currents even of a very minute order would produce a type of softening other than that caused by saponification in the well-known manner.

Secondly, that moisture must have been a factor in the case, although it was not proved that it had any other function than that of rendering fibrous coverings and other paths conductive.

Thirdly, it appeared likely that, in the presence of the two preceding factors, this particular form of softening occurred more readily in tropical than in temperate climates, and that temperature was therefore also a factor.

Fourthly, time is obviously important in all changes of the kind under consideration.

The results of a number of preliminary experiments showed that the softening could be produced by the combined action of heat and moisture. Also that the time element, which even under faulty electrical conditions might be years, could be reduced to weeks or even hours by varying the temperature.

(To be concluded.)

Discussion at Manchester.

Prof. E. W. Marchant said, with regard to dielectric stress, the author stated that in order to obtain the best results the ratio between the outer and inner diameters should be the base of natural logarithms; this also corresponded to the condition in a cable for which there would be no possibility of corona forming in the interior. He cited a case of electrolytic action which occurred in a bitumen cable some years ago; the negative of the cable broke down, and intermingled with the friable substance round the joint was a considerable quantity of pure sodium and pure potassium, which resulted in considerable local heating, which attracted attention to the fault.

Mr. B. Welbourn said that the modern manufacturer of paper cable had made so much progress that it was perfectly safe to re-design on a scientific basis all cables coming under the British Engineering Standard List. It was perfectly safe to cut down dielectric thicknesses, provided the cables were used on modern systems having a sine wave-form. This would not apply to systems employing alternators of ten years ago, having peaky waves. Since the cable manufacturer could not control the destination of his cable, the safest procedure was probably to retain the British Engineering Standard thicknesses over a given voltage, but to put them down deliberately with the idea that in the future the working pressure might be doubled as loads increased. He asked whether the author, in suggesting a high-voltage single-core cable, had considered it commercially justifiable at commercial frequencies of 25 to 50 cycles. The statement in the paper that inter-sheathed grading was not commercially justifiable below 30,000 volts raised the whole question of working pressure on cables. He

* Report of Board of Trade Committee on Electric Mains Explosions, 1914.

agreed with the inference in the paper that 50,000 volts was the commercial limit of pressure for three-core cables, and said there was scarcely a case where anything higher than 30,000 volts could be justified at 50 cycles on account of the charging current and consequent idle plant. In a particular case, at 11,000 volts the apparent KW. required to charge the cables were 18.2 per mile, for 20,000 volts 23.8 KW. per mile, and for 30,000 volts 84.5 KW. per mile. Therefore, with a network involving 30 miles of 30,000-volt cable, the plant required to charge the cable alone would be about 2,500 KW. He had investigated several cases involving three-core underground cables and, taking into account the cost of transformers, switchgear, etc., there was hardly any saving in going above 30,000 volts. Paper cables which had been working at 2,000 volts 100 cycles for 23 years had shown no sign of deterioration of the paper. They had also had 18 years' experience with 11,000 volts, eight years' with 20,000 volts, and three years' with 30,000 volts. Tests he had made on the effect of long-continued application of pressure to cables on a modern system at high temperatures, about two years ago, showed that there was practically no deterioration of the paper. The trouble with expansion and contraction could be easily overcome by the use of the Vernier joint. He had constructed joints insulated with tape and paper capable of withstanding a working pressure of 150,000 volts. For protection against electrolytic corrosion of lead, continuity and cross-bonding was not sufficient; the predetermined points should be earthed. Systematic examination of continuity, cross-bonding and earthing was essential, for the equipotential points of a system altered.

Mr. S. L. PEARCE said that in connection with the new power station of the Manchester Corporation he felt justified, after careful consideration, in using a cable of 0.25 sq. in. at 33,000 volts. Regarding the grading of cable insulation, he thought engineers would rather pin their faith to a single dielectric which had been fully proved. The various suggestions for anchoring the lead inter-sheaths were ingenious, but they did not appeal to him. The author seemed to suggest that the existing methods of testing cables at 2½ to 3 times working pressure should be followed; so far as the Board of Trade had issued regulations at all at the present time, all they required for cables at a working pressure over 10,000 volts was an extra 10,000 volts. Evidently when working pressures of 40,000 or 50,000 volts were reached engineers would have to be content with a test pressure much less than 2½ or 3 times the working pressure. Regarding the time element in pressure tests, his experience showed that if a cable stood the first five minutes it would not break down in half an hour. The author's suggestion for testing the integrity of lead sheaths was an excellent one, and could be applied whilst working. The insulation resistance value of 50 megohms per mile was altogether too low. The question of movement in cables consequent upon expansion and contraction was of prime importance. The author condemned the impression that vulcanised bitumen was softened by contact with coal gas; if the bitumen filling did contract by the action of coal gas, which the author did not dispute, something else would soon come in to destroy the cable. He had for some years discarded it.

Mr. A. F. W. RICHARDS said it was impossible to forecast the density of the load on distributors for years in advance and consequently they were grossly overloaded now and then. With regard to the joint suggested for pressures of 50 to 100 kilovolts, the idea of non-hygroscopic spacers seemed excellent, but the weak spot was the difficulty of leaving the ferrules absolutely smooth after sweating, as pin points of solder were often sufficient to cause a breakdown at very high pressures. As regarded bonding on lead-covered cable, nothing but a plumber's "wipe" was satisfactory. There were various satisfactory forms of clamps and cone connectors for wire-armoured cables which made a sound job if attention was paid to cleaning the wires and providing a good fit. On solid-laid systems bridges should invariably be of non-hygroscopic material, and for use in this country he preferred asphalt. The proper filling of the trough was a difficult matter; the bends should be left until the last.

Mr. J. H. C. BROOKING said rubber cables, bitumen cables, and lead-covered cables had all been run down at various periods, but they were all perfectly correct under certain circumstances. The author had shown that with proper laying and maintenance, troubles did not appear.

Mr. G. L. PREECE thought the suggestion that 30,000 volts was the highest economical pressure nowadays was probably correct, but the author must have had other views in designing and making cables for 100,000 volts.

Mr. W. S. TAYLOR referred to a good tin coating on rubber-insulated conductors as being essential for long life. There was a general impression that the tin protected the conductor against the sulphur in the rubber, whereas the tin was essential to protect the rubber from the copper. English practice was directly opposed to American and Continental practice in the use of pure rubber adjacent to the conductor. Could it be that English methods were open to improvement?

Mr. L. J. LEPINE said that the 100,000-volt cables which Prof. Klingenberg proposed to lay down in London were in reality 60,000-volt cables. The idea was to use single-core cables and earth the star points, thereby obtaining a potential difference of 60,000 volts between cable and earth. Recently the Victoria Falls Co. decided to install some 60,000-volt cables with a section of 120 mm². The German experts put forward a cable of 500 mm². which they recommended, the object being to reduce the stress. An alternative of 120 mm². was offered and accepted, but when officially inspected it was only 100 mm². He had just returned from Germany, and said that no German manufacturer was allowed to export cable having a greater section than 35 mm².

Dr. G. W. WORRALL, referring to the use of tapes and other materials used in jointing, spoke of a 90-H.P. 5,000-volt pit motor which broke down on one coil. The coil was repaired in the pit, and after about a month's run it broke down again in the same place. After a second repair there was another breakdown, and ultimately the motor was brought to the shops and repaired successfully. The repeated failure was due to the insulating materials becoming damp in the pit, although they were perfectly dry when first sent down. He referred to the heating of bifurcating boxes on three-phase systems, due to the three cable ends entering the box by three separate holes and thereby heating the metal of the casing.

The AUTHOR, in reply, said that vulcanised bitumen breakdowns were well known in the old days and the formation of potassium and sodium in the metallic state repeatedly caused fires in the culverts. Commercial considerations would restrict the use of high-voltage cable to feeding overhead lines, connecting generators and transformers, etc., and consequently such cables would never be used in tremendous lengths, in which case the charging current would not enter largely into the question. There was no necessity to attach a time limit to the maximum stress figures in the paper; the maximum stress figure quoted was one that the paper just failed to support. Regarding the pressures suggested for test purposes, the author feared that those quoted would be demanded, although there was no reason why they should. With regard to bitumen cables, the paper separator was not for mechanical purposes but to prevent the selective action which had been described. The author had known a consignment of lead cable to be very badly affected by vibration in transit aboard ship. The German practice of making high-tension tests and no resistance test was very bad; a water-logged cable might prove all right on high-tension test, owing to general leakage, but a megohm test would prove the cable faulty. Varnished tapes were not used for binding purposes; tapes were treated with the insulating compound immediately before they were applied. In this way a perfectly satisfactory dielectric was obtained.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE war is naturally affecting this country a good deal, and there is a considerable amount of unemployment, but, on the whole, conditions are much better than most people, at the commencement of the fighting, expected.

In all possible ways the Dominion and Provincial Governments together with the municipalities, are trying to carry on necessary works in order to give employment, although some of the smaller towns are unable to do very much, since they are short of money.

A large power development scheme now in progress is that of the Laurentide Pulp and Paper Co., at Grand Mère, Quebec, on the St. Maurice River, which is a tributary of the St. Lawrence. A total head of about 77 ft. will be utilised. The ultimate plant capacity is designed to be 180,000 H.P., but only a portion of this will be installed at first. About 25,000 H.P. are required by the company, and the remainder will be available for distribution and sale to others. A very interesting feature about this scheme is that the name Grand Mère was given to a particular rock which has the appearance of an old woman; evidently it is necessary to remove this old lady from her ancestral home on an island, for she is to be carefully transported to the mainland and established there—one wonders how she will stand the strain and worry of removal at her great age.

The Board of Control in Toronto is reported to have recently passed a resolution instructing counsel to apply to the Dominion Railway Board for an order compelling all railways within, and up to two miles from, the city limits to electrify their systems, and the Toronto Street Railway Co. has just been ordered by the Ontario Railway and Municipal Board to provide 50 new cars and carry out a number of other improvements. The Toronto hydro-electric system has been spending large sums of money, totalling almost $1,000,000 beyond the amount which it was authorised to spend; the City Council was asked to sanction the raising of $2,000,000, but has only given its consent for $1,000,000.

In Montreal the Electrical Commission recently decided to discontinue its operations on underground conduit construction, but the contractor came forward with an offer to go on with the work at his own expense until the middle of next summer, provided he is paid then for work done; the Commission has accepted the offer, and it is to be inferred that the work will proceed.

The Hydro-Electric Power Commission of Ontario has recently let a contract for the construction of a large office building, the whole of which will be occupied by the Commission, its staff of engineers, its laboratories and testing departments, &c. The total cost will be about $200,000.

Until quite recently the Commission acted merely as a middleman in regard to electric power, as it bought all its power in bulk at Niagara and sold it to various municipalities. On October 7th, however, a new phase of its work commenced, viz., that of the supply of power from a generating station designed, owned and operated by its own staff.

This plant, which is only a small one of about 1,000 H.P., is located at Wasdell's Falls, on the Severn River, about 80 miles north of Toronto; power is transmitted to the municipalities of Beaverton, Woodville, Cannington, Gamebridge, Brechin, and the intervening agricultural districts. Another plant of about 4,000 H.P., capable of some extension, is now under construction at Eugenia Falls, on the Beaver River; these falls are about 75 miles north-west of Toronto.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SOUTHERN RHODESIA.—A copy of the proposed new Customs Tariff of Southern Rhodesia has been received at the Board of Trade. The General Tariff rates are the same (except as regards some prohibitions) as those leviable in the Union of South Africa, but, in consequence of the operation of what is known as the "Rhodes Clause," the preferential rates of duty on British goods are not, in all cases, identical with those leviable in the Union of South Africa.

Upon the following articles the rates will be operative from the date of promulgation of the Ordinance giving effect to the same.

Catalogues or price lists of foreign firms, addressed to importers, merchants or manufacturers, or public libraries and similar institutions—	Free
Diagrams, designs, drawings, models and plans— ...	Free
Belting of all kinds for driving machinery— ...	3 % ad. val.
also rope for driving, and transmission hose— ...	(v. Note 1)
Cranes, elevators and shears—	3 % ad. val. (v. Note 1)
Electroliers, hand lamps and fancy fittings—15 per cent. ad. val. with a rebate of 6 per cent. on goods, the manufacture of any part of H.M. Dominions or of any British Protectorate.	
Machinery for manufacturing, mining and other industrial purposes. Machinery, apparatus, appliances, implements, and electrical material used in connection therewith, for the generation, storage, transmission, distribution of, and lighting by, gas or electric power, but not including electroliers, hand-lamps or fancy fittings... ...	3 % ad. val. (v. Note 1)
Packing and lagging for engines, machinery and piping	3 % ad. val. (v. Note 1)
Pipes, piping, and tubes of all kinds for gas, steam, &c.	3 % ad. val. (v. Note 1)
Railway construction or equipment requisites ...	3 % ad. val. (v. Note 1)
Telegraph and telephone materials and instruments...	3 % ad. val. (v. Note 1)
Tramway construction or equipment requisites—including railless cars (electric)	3 % ad. val. (v. Note 1)

NOTE 1.—A rebate of the whole of the duties will be granted on goods the produce or manufacture of any part of H.M. Dominions or of any British Protectorate.

NOTE 2.—The value of goods for purposes of *ad valorem* duty will be taken to be the true current value for home consumption in the open market of similar goods in the principal markets of the country from which and at the time at which the goods were imported, including carriage to the port of shipment and the cost of packing and packages, but not including agent's commission when such commission does not exceed 5 per centum, provided that in no case shall the value for purposes of duty be less than the cost of the goods to the importer at the port of shipment.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,582. "Magnetic games." D. M. HUMBY. November 16th.

22,598. "Night-marching compasses and the like." F. E. COLLINSON and SHORT & MASON, LTD. November 16th.

22,609. "Regulating device applicable to self-induction coils or to windings of Tesla transformers used in wireless telegraphy or other applications of high-frequency." L. ROUZET. November 16th.

22,614. "Electric ignition systems for internal-combustion engines." L. H. HOUNSFIELD. November 16th.

22,632. "Compensating resistances for dynamo and motor field windings and the like." F. BRIMSON COX. November 17th.

22,674. "Methods of using electric condensers for transformation of energy." J. E. TAYLOR. November 18th.

22,691. "Footsteps for telegraph and like poles, brackets for shelving, and other like brackets." BULLERS, LTD., & B. WOOD. November 18th.

22,713. "Inverse-current preventer." E. E. GREVILLE. November 18th.

22,715. "Automatic and semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., & W. AITKEN. November 18th.

22,716. "Manual and semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., & W. AITKEN. November 18th.

22,721. "Speed governors." WARWICK MACHINERY CO. (1908), LTD. November 18th. (General Electric Co., United States.)

22,732. "Means for regulating the speed of electric motors." ALLMANNA SVENSKA ELEKTRISKA AKTIEBOLAGET. November 18th. (Convention date, January 5th, 1914, Sweden.) (Complete.)

22,741. "Magnetos." M. PEDERSEN. November 19th.

22,744. "Grinders for commutators or distributors of "Ford" or other motor-car engines." W. L. ROSS. November 19th.

22,779. "Dynamos." S. J. WILLIAMS. November 19th.

22,804. "Control of electric circuits." A. P. LUNDBERG, G. C. LUNDBERG, P. A. LUNDBERG, & G. PEGG. November 20th.

22,807. "Wireless control systems." M. COMPARE. November 20th.

22,826. "Alternating electric current rectifiers." BRITISH THOMSON-HOUSTON CO., LTD. November 20th. (General Electric Co., United States.)

22,837. "Method of and apparatus for producing vibratory motion." W. J. MELLERSH-JACKSON. November 20th. (Submarine Signal Co., United States.) (Complete.)

22,854. "Arrangements for producing pulsating or alternating currents, particularly of a high frequency." R. MERCER. November 21st.

22,867. "Electrolytic cells." H. C. JENKINS, H. F. PATTINSON, & R. WELLESLEY. November 21st.

22,868. "Electrical relays." H. G. BARWELL, W. JUDD, & EASTERN TELEGRAPH CO., LTD. November 21st.

22,871. "Regulating devices for mixed pressure turbo-compressors." WARWICK MACHINERY CO. (1908), LTD. November 21st. (General Electric Co., United States.)

22,872. "Electric heating apparatus of the kind known as electric resistance units." C. O. BASTIAN. November 21st.

22,879. "Apparatus for directed wireless telegraphy and telephony." E. BELLINI. November 21st. (Convention date, June 24th, 1914. France.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

1913.

22,266. METHOD OF CONTROLLING AND REGULATING TRAINS OR OTHER ROLLING-STOCK ON RAILWAYS. T. Barbour & W. S. Suffern. October 3rd.

22,331. ELECTRIC INCANDESCENCE BODIES SUITABLE FOR USE IN GLOW LAMPS, OR/AND IN THE METHODS OF MANUFACTURING THE SAME. C. O. Bastian. October 3rd.

23,218. ELECTRICAL COOKING APPARATUS. R. S. Downe and Brompton & Kensington Accessories Co. October 14th.

23,959. ELECTRODES FOR USE IN THE PRODUCTION OF NITRIC OXIDE. C. Rossi. October 22nd. (October 22nd, 1912.)

24,198. ELECTRIC SWITCHES. V. Hope. October 25th.

24,337. ELECTRIC ROTARY CONVERTERS WITH COMMUTATING POLES. Akt. Ges. Brown, Boverie et Cie. October 27th. (September 20th, 1913. Addition to 24,305/13.)

24,672. QUICK-ACTION MECHANISM FOR ELECTRIC SWITCHES AND OTHER DEVICES. J. Roothaan & Ferranti, Ltd. October 30th.

25,006. THREE-POSITION BLOCK INSTRUMENT FOR RAILWAY AND TRAMWAY PURPOSES. McKenzie & Holland, Ltd., & C. H. W. Edmonds. November 3rd.

25,283. TELEPHONE SYSTEMS. J. Savin. November 5th.

25,437. DEVICE FOR RECORDING OR COUNTING TELEPHONE CALLS. A. R. Denbigh. November 7th. (May 5th, 1914.)

25,544. FITTINGS FOR ELECTRICAL CONDUIT SYSTEMS. D. L. J. Broadbent. November 8th.

25,621. ELECTRIC SOLDERING-IRONS. L. Newitt & F. P. Fletcher. November 10th.

27,611. APPLICATION OF ELECTRICAL ENERGY TO MOTOR-CARS, MOTOR-BOATS, AND THE LIKE. F. A. Wilkinson. December 1st.

27,870. ELECTRIC SWITCHES. A. Bonnella & G. J. Bonnella. December 3rd.

28,952. TELEGRAPH RECEIVING-APPARATUS ADAPTED TO SPLIT UP INCOMING SIGNALS INTO THEIR COMPONENTS AND TO ACTUATE A TRANSMITTER OR ANALOGOUS DEVICE, OR TO PERFORATE A TAPE ACCORDING TO EITHER THE WHEATSTONE, CABLE, OR OTHER SYSTEMS OF WORKING. Eastern Telegraph Co., A. Fraser, & K. L. Wood. December 16th.

29,691. ELECTRIC SIGNALLING. C. R. Pratt & Orling's Telegraph Instruments Syndicate, Ltd. December 24th.

29,779. ELECTRIC CAPSTANS. W. Dixon. December 24th.

1914.

1,227. DYNAMO-ELECTRIC STARTING-MECHANISM FOR INTERNAL-COMBUSTION ENGINES. H. Lucas & W. C. Turner. January 16th.

2,844. DEVICES FOR AMPLIFYING FEEBLE IMPULSES OF ELECTRIC ENERGY. W. L. Richards. February 3rd. (February 8th, 1913.)

3,012. SOUND-PRODUCING HORNS FOR MOTOR ROAD VEHICLES AND THE LIKE. H. Lucas & W. H. Edwards. February 5th.

3,552. ELECTRIC TRAIN OR TRAM CONTROL SYSTEMS. J. R. Beard & W. L. Shand. February 11th.

4,249. RUNNING ELECTRIC MOTORS ON CONTINUOUS OR ALTERNATING-CURRENT SUPPLY SYSTEMS. R. Haddan (D. A. Marks). February 18th.

6,210. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE EXCHANGE SYSTEMS. G. A. Betulander. March 11th. (May 24th, 1913. Addition to 29,615/13.)

7,079. POCKET AND OTHER ELECTRIC FLASHLIGHT BATTERIES. J. W. Mander. March 20th.

7,331. TELEPHONE SYSTEMS. E. A. Graham. March 23rd.

7,884. ELECTRICAL INSULATION FOR RAIL OR TRACK CIRCUITS FOR RAILWAYS OR TRAMWAYS. B. R. Wills & J. C. Sykes. March 28th. (Divided application on 19,603/13. August 29th. Cognate application, 7,885/14.)

10,514. RENEWABLE ELECTRIC CARTRIDGE FUSES. N. D. Urquhart. April 28th. (May 6th, 1913.)

11,845. METHOD OF RENEWING AND REPLACING CONDUITS WITH INTERNALLY PACKED AND EXTERNALLY LEAD-FILLED SOCKETS. A. A. C. Boas & J. Quist. May 13th. (May 14th, 1913.)

15,399. VACUUM TUBE LIGHTING APPARATUS. F. Meyer. June 26th. (June 28th, 1913.)

15,455. ELECTRIC FURNACES. F. J. Machalske. June 27th. (June 27th, 1913.)

17,025. ELECTRIC POCKET LAMPS. G. F. Hitzelberger & New British Ever-Ready Co. July 17th.